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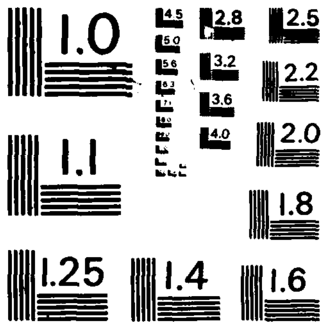
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SAN FRANCISCO BAY TO STOCKTON, CALIFORNIA PROJECT

FINAL

INTERIM DESIGN MEMORANDUM No. 5
AND
ENVIRONMENTAL IMPACT STATEMENT

JOHN F. BALDWIN SHIP CHANNEL
PHASE II
RICHMOND HARBOR APPROACH

MAY 1984

US Army Corps
of Engineers
San Francisco District

REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER	2. GOVT ACCESSION NO. A142416
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) JOHN F. BALDWIN SHIP CHANNEL PHASE II, INTERIM DESIGN MEMORANDUM ENVIRONMENTAL IMPACT STATEMENT	5. TYPE OF REPORT & PERIOD COVERED Final
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U. S. Army Engineer District, San Francisco Corps of Engineers, 211 Main Street San Francisco, California 94105	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U. S. Army Engineer District, San Francisco Corps of Engineers, 211 Main Street San Francisco, California 94105	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Office of the Chief of Engineers U. S. Department of the Army Washington, D. C. 20314	12. REPORT DATE May 1984
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified
	15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Navigation
Environmental Impacts
Dredging
Disposal

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A combined Design Memorandum and Environmental Impact Statement for proposed navigation improvements at Richmond Harbor, California. The planning process and the design considerations that led to the selection of the plan and its alternatives as well as the environmental consequences resulting from the implementation of those plans are discussed in the report.

SAN FRANCISCO BAY-TO-STOCKTON
CALIFORNIA
(JOHN F. BALDWIN & STOCKTON SHIP CHANNELS)

FINAL
INTERIM DESIGN MEMORANDUM NO. 5
AND
ENVIRONMENTAL IMPACT STATEMENT

JOHN F. BALDWIN SHIP CHANNEL
PHASE II
RICHMOND HARBOR APPROACH

May 1984

Department of the Army
San Francisco District, Corps of Engineers
San Francisco, California

INTERIM DESIGN MEMORANDUM NO. 5 AND ENVIRONMENTAL IMPACT STATEMENT
JOHN F. BALDWIN SHIP CHANNEL
PHASE II
RICHMOND HARBOR APPROACH

DESIGN MEMORANDUM

No.	Date	Title	Approved
1.	Sept 80	Avon to Stockton	18 Dec 81
2.	Nov 68	Bank Protection	20 Dec 68
3.	June 69	Levee Setbacks	6 Jan 70
4.	Apr 71	San Francisco Bar	17 Aug 71
5.	May 84	Richmond Harbor Approach	
6.		San Pablo Bay and Mare Island Strait	
7.		Carquinez Strait and Suisun Bay Channels	

A-1

INTERIM DESIGN MEMORANDUM NO. 5
JOHN F. BALDWIN PHASE II
Pertinent Data of Recommended Plan

1. GENERAL DATA

Name	San Francisco Bay to Stockton, California (John F. Baldwin and Stockton Ship Channels)
Authorization	River and Harbor Act of 1965 Public Law 89-298
Water Body	San Francisco Bay
Counties and State	Contra Costa and San Francisco, California
Purpose	Navigation
Local Sponsor	Contra Costa County

2. NAVIGATION DATA

Location	Central San Francisco Bay near Richmond, California
Length	1.1 miles (Maneuvering Area, irregular)
Depth	-45 feet MLLW
Bottom Width	600 Feet
Side Slopes	1V on 3H
Dredging	8,800,000 cys
Disposal	Aquatic at Alcatraz Disposal Site (SF-11).

3. ECONOMIC DATA

a.	First Costs		
	Federal	$41,200,000	
	Non-Federal	1,300,000	
	Total	$42,500,000	
b.	Inst. Dur. Const.	$ 2,050,000	
c.	Annual Cost	(50 years @ 3-1/4%)	(50 years @ 8-1/8)
	Capital	$1,815,000	$3,694,000
	O&M	250,000	250,000
	Total	$2,065,000	$3,944,000
d.	Annual Benefits		
	Navigation	$5,969,000	$5,930,000
	Net Benefits	3,904,000	1,986,000
e.	Benefit-Cost Ratio	2.9 to 1	1.5 to 1

SYLLABUS

The purpose of this report is to recommend for construction, a plan of improvements for the Central San Francisco Bay segment of the John F. Baldwin Ship Channel. This project is part of the San Francisco Bay to Stockton Project authorized by Congress in 1965. The San Francisco District, U.S. Army Corps of Engineers is the responsible agency for the construction of the John F. Baldwin Ship Channel. The Sacramento District, U.S. Army Corps of Engineers is the responsible agency for the construction of the Avon to Stockton Ship Channel. Advanced engineering and design and construction of the John F. Baldwin Ship Channel is proceeding in three phases. Phase I was constructed in 1974 and consists of a Main Ship Channel 55 feet deep and 2000 feet wide across the San Francisco Bar. Phase II, the subject of this report, provides channel improvements in Central San Francisco Bay near Richmond, California. Phase III provides for channel improvements in San Pablo Bay, Carquinez Strait and Suisun Bay to Point Edith. The impetus for channel improvements in Central San Francisco Bay is the worldwide trend toward larger tankers with correspondingly deeper drafts, to transport crude petroleum and a progressive increase in the demand for crude petroleum.

Refinery facilities located at Richmond rely on waterborne transportation to supply most of their crude petroleum stocks. The present channel depth of -35 feet MLLW restricts the size of tankers that can safely use existing channels to 30-foot draft vessels. Deeper draft vessels generally in use today must be lightered or wait for high tides in order to use the existing channels to the refinery facilities. In addition the routing of larger tankers via the West Richmond Channel is considered risky due to man-made and natural obstructions to navigation.

Various solutions to the problems and needs related to inadequate deep-draft access to Richmond refining facilities were analyzed. Included were both dredging and non-dredging alternatives. The non-dredging alternatives gave consideration to a deep-water in-bay terminal and an ocean monobuoy system. Dredging alternatives considered improvements in either the Southampton Shoal Channel or the West Richmond Channel.

As presented herein, the provision of improved deep-water access to Richmond refining facilities is warranted and the Southampton Shoal Channel is the best route to provide that access. The Southampton Shoal Channel is the most direct and safest route to the Richmond refining facilities and it is the preferred route of the users. The proposed 45-foot depth will increase the number of tankers calling at Richmond without lightering or tidal delays by 38 percent over present day conditions.

The improvement of the Southampton Shoal Channel would consist of dredging 1.1 miles of existing channel and the existing Richmond Long Wharf Maneuvering Area from -35 feet (MLLW) to -45 feet (MLLW). An estimated 8,800,000 cubic yards of material would be dredged and disposed of in the approved Alcatraz Island Disposal Site. The estimated first cost of construction is $42,500,000. Annual costs are estimated at $2,065,000 including capital costs and operations and maintenance.

Transportation cost savings resulting from the recommended improvements would yield annual benefits of $5,969,000. These cost savings stem from the reduction in lightering and tidal delays. Other benefits which may result from the improvements include a reduction in the potential for accidental petroleum spills during lightering and the elimination of the need to navigate in a hazardous area. The project has a benefit/cost ratio of 2.9 to 1. Implementation of the recommended improvement will not adversely affect wetlands, endangered species or water quality of San Francisco Bay. The primary environmental impact of the project results from dredging and disposal operations which disturb benthic communities and increase turbidity levels at the dredging and disposal sites. These impacts manifest themselves in the lower portion of the food web of the San Francisco Bay System but, the overall effect on the biological productivity of the Bay is not considered to be of major consequence over the long term.

JOHN F. BALDWIN SHIP CHANNEL
PHASE II
RICHMOND HARBOR APPROACH

FINAL
INTERIM DESIGN MEMORANDUM NO. 5
AND
ENVIRONMENTAL IMPACT STATEMENT

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JOHN F. BALDWIN SHIP CHANNEL
PHASE II
RICHMOND HARBOR APPROACH

SECTION 1

INTRODUCTION

1.01 This section presents information on the purpose, authorization, study area, scope, coordination, study methodology, report format a. prior studies related to this Memorandum.

1.02 Purpose of Study. The purpose of this study is to eva te (affirm or reformulate) the subject deep-draft navigation project using ent engineering, economic, environmental and institutional crite. The plan of improvement recommended as a result of this evaluation is developed to an advanced level (General Design Memorandum) of detail so as to proceed directly to the preparation of construction plans and specifications upon approval.

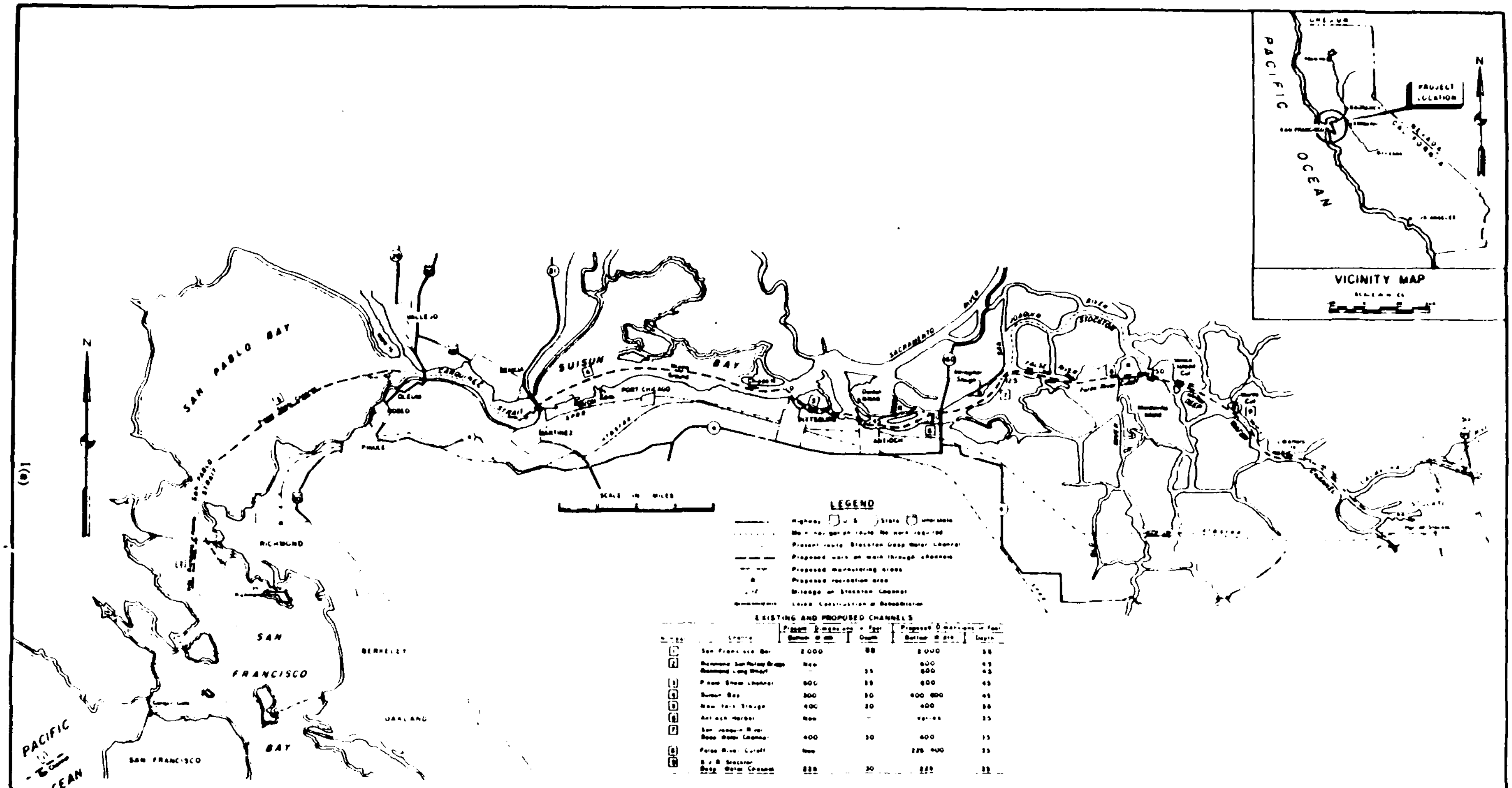
1.03 Authority. The San Francisco Bay to Stockton, California (John F. Baldwin and Stockton Ship Channels) Navigation Project was authorized by the River and Harbor Act of 1965 as contained in Public Law 89-298, Eighty-Ninth Congress, dated 27 October 1965. The authorization reads in part as follows:

> "The following works of improvement of rivers and harbors and other waterways for navigation . . . are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and supervision of the Chief of Engineers in the respective reports hereinafter designated . . . San Francisco Bay to Stockton, California: House Document 208, Eighty-ninth Congress, at an estimated cost of $46,853,000."

1.04 Description of Authorized Project. The plan of improvement recommended in House Document 208, consists of modification to five existing channel projects and construction of a new channel in Carquinez Straits. The authorized improvements are briefly described in the following paragraphs and further summarized in Table 1. Figure 1 is a general map of the project area showing the location of each authorized project segments. All depths are relative to Mean Lower Low Water (MLLW).

a. Main Ship Channel - San Francisco Bar. The authorized improvements for the Main Ship Channel provide for deepening the channel across San Francisco Bar from 50 to 55 feet, but retaining the existing width of 2,000 feet. This work was completed in February 1974.

b. West Richmond Channel - Central San Francisco Bay. The authorized improvements consist of deepening the West Richmond Channel to a depth of 45 feet and a bottom width of 600 feet. The existing project maneuvering area near the Richmond Long Wharf, which now has a depth of 35 feet, would be deepened to 45 feet and extended toward deep water near the east navigation opening of the Richmond/San Rafael Bridge. This is the authorized segment addressed by this Interim Design Memorandum.



SAN FRANCISCO BAY TO STOCKTON
(John F Baldwin and Stockton Ship Channels)

CALIFORNIA

U.S. ARMY ENGINEER DISTRICT
SAN FRANCISCO, CALIFORNIA

FIGURE 1

TABLE 1

Existing Channels and Facilities
and Authorized Modifications

Existing Project No.	Channel or Facility	EXISTING Depth (feet)	EXISTING Width (feet)	AUTHORIZED MODIFICATION Depth (feet)	AUTHORIZED MODIFICATION Width (feet)
1	San Francisco Bar Channel: (Completed)	55	2,000	55	2,000
2	West Richmond Channel:	-	-	45	600
	Richmond Long Wharf Maneuvering Area	35	Irregular	45	Irregular
3	Pinole Shoal Channel:	35	600	45	600
	Oleum, Port Costa & Martinez Maneuvering Areas				
4	Carquinez Strait Channel: (New Channel)	-	-	45	Irregular
5	Suisun Bay Channel:				
	Martinez to Avon	35	300	45	600
	Avon to Middle Point	30	300	45	600
	Middle Point to Chipps Island	30	300	45	400
	Chipps Island to New York Slough (Pittsburg)	30	300	35	400
6	Stockton Deep Water Channel:				
	Pittsburg to Antioch	30	400	35	400
	Antioch Harbor Area	-	-	35	400
	Antioch to Stockton				
	Antioch to False River	30	400	35	400
	False River Cutoff (new channel)	-	-	35	225-400
	False River Cutoff to Stockton	30	225	35	225 (*)

(*) 250 feet in bends.

c. Pinole Shoal Channel - San Pablo Bay. The Pinole Shoal Channel, which is within the limit of the San Pablo Bay and Mare Island Strait project, would be deepened to 45 feet across its present 600-foot bottom width and lengthened to approximaely 9 miles to connect the naturally deep waters of San Pablo Bay and Carquinez Strait. The maneuvering area near the Union Oil Company wharf at Oleum would be deepened to 45 feet and enlarged somewhat to accommodate larger tankers.

d. Carquinez Strait Channel. A new 45-foot deep and 600 to 800-foot wide channel would be excavated through the shoal areas of upper Carquinez Strait in the Martinez-Benicia complex. A maneuvering area south of the main channel in the vicinity of the Shell and Lyon (Tosco) Oil Company piers at Martinez would be deepened to 45 feet. The channel would taper to approximately 300 feet wide at the Interstate 680 highway bridge and the Southern Pacific Railroad Bridge to utilize the existing navigation openings under these bridges.

e. Suisun Bay Channel. The authorized improvement for Suisun Bay includes deepening the channel from the existing depths of 35 and 30 feet to 45 feet between Martinez and Chipps Island and to 35 feet from Chipps Island to New York Slough. Deepening the channel to 45 feet from Avon to Chipps Island is contingent upon development of a refinery near Chipps Island or development of other heavy industry requiring deep-draft ships. The authorization provides for widening the existing channel bottom to 600 feet upstream to Middle Point, east of the piers at the Concord Naval Weapons Station at Port Chicago, and to 400 feet upstream to the mouth of New York Slough. The channel between Martinez and Avon was deepened to 35 feet under the authority of Section 107 of the 1960 River and Harbor Act (P.L. 86-845) subsequent to authorization of the San Francisco Bay Stockton project.

f. Stockton Deep Water Channel.

(1) Pittsburg to Antioch. The authorized plan for improvement through New York Slough from Pittsburg to Antioch is to deepen the existing channel to 35 feet. The authorization also provides for the installation of bank protection on levees within 1,000 feet of channel along this reach over a 5-year period, and all necessary utility relocations.

(2) Antioch Harbor area. The authorized channel modifications in the vicinity of Antioch include realigning the channel south of West Island and providing a channel 400 feet wide and 35 feet deep. The authorization also provides for a branch of the channel to be extended along the south shore of San Joaquin River near Antioch to the Antioch Bridge. The channel extension would function as a maneuvering area and entrance channel to a potential harbor near to Antioch Bridge. A turning basin 1,200 feet square at 35 feet deep is authorized for construction between the potential harbor site and the through channel south of the upstream tip of West Island. Construction of the channel and turning basin south of West Island is dependent upon the need for deep water facilities along the south shore in the vicinity of Antioch. If the need for deep water facilities in that location does not materialize, deepening of the existing channel north of West Island to 35 feet is authorized. The authorization includes installation of bank protection on levees within 1,000 feet of the channel with construction to be accomplished at critical sites over a 5-year period after completion of the channel.

(3) Antioch to Stockton. The authorized channel modifications from Antioch to Stockton include deepening the existing 400-foot wide channel to 35 feet from Antioch Bridge to the mouth of False River, and constructing a new deep water channel through False River, across the inundated portion of Franks Tract and through the northern tip of Mandeville Island. The authorized channel would be 35 feet deep and 225 feet wide between confining levees, with widening to 250 feet in curves, and it would be 400 feet wide across the open portion of Franks Tract. The authorized modifications also include deepening the existing channel to 35 feet from Prisoners' Point to the eastern limits of the existing turning basin opposite the Port of Stockton. The Sacramento District, however, has eliminated the False River route and is currently improving the existing channel to authorized dimensions. Bank protection work was completed in 1972 along about 4,700 linear feet of levee at six sites bordering the channel from Venice Island to Stockton.

1.05 Division of Project Responsibilities. Project responsibilities are divided geographically between the San Francisco and Sacramento Districts of the Corps of Engineers. San Francisco District is responsible for planning engineering and construction of the San Francisco Bar Channel, the West Richmond Channel, the Pinole Shoal Channel, the Carquinez Strait Channel and a portion of the Suisun Bay Channel segments of the project. The upstream terminus of San Francisco District's projects is at Point Edith near the boundary line between the San Francisco and Sacramento Districts. The segments below Point Edith are collectively referred to as the John F. Baldwin Channel (PL 90-46, July 4, 1967). Sacramento District is responsible for design and construction of the segments upstream of Point Edith which are known as the Suisun Bay and Stockton Ship Channels.

1.06 Scope of Study. This study is limited to the evaluation of constructing the segment of the authorized project located in the Central San Francisco Bay referred to as Phase II of the Project. This segment, as authorized, includes deepening of the West Richmond Channel and Richmond Long Wharf Maneuvering Area. Project benefits for this segment are based on increased efficiency of transporting crude petroleum to the Richmond Long Wharf and adjacent refinery. These benefits would be realized independently of the disposition of remaining project segments. Although upstream benefits may occur as a result of deepening West Richmond Channel these benefits will not be addressed in this study. Design of the selected plan is developed to a level of detail sufficient to proceed with preparation of construction plans and specifications upon approval of this Interim Design Memorandum.

1.07 Study Process. Alternative plans are formulated in response to identified concerns, problems and opportunities in the study area. These plans are evaluated in terms of engineering, economic and environmental considerations. Viable plans are retained for further detailed evaluation. Public input is solicited and incorporated at appropriate points throughout the study process. Throughout the study, contact was maintained with representatives of Federal and State agencies and local interests with jurisdictional responsibilities or special concerns within the area under consideration. Federal agencies included the Environmental Protection Agency, Fish and Wildlife Service, National Marine Fisheries Service, Twelfth Coast Guard District, and Twelfth Naval District.

Agencies of the state of California that contributed to this study included the San Francisco Bay Conservation and Development Commission, Department of Fish and Game and San Francisco Bay Regional Water Quality Control Board. Numerous local interests also contributed including Contra Costa County, City of Richmond, Richmond Model Cities Economic Development Program Committee, Contra Costa County Development Association, San Francisco Bar Pilots, California Inland Pilots Association, Port of Richmond, Chevron and various other shipping companies.

1.08 Report Format. This report consists of a main report, Environmental Impact Statement and seven appendices. The main report presents the study which resulted in selection of the plan recommended for construction. The appendices are detailed reports containing the technical information which supplement the study. The Environmental Impact Statement focuses the study in the light of the National Environmental Policy Act.

SECTION 2

PROBLEM IDENTIFICATION

The problem identification task is undertaken to define the physical setting and the nature of water and related land resources management problems. The task culminates in the delineation of planning constraints and planning objectives specific to the study area which guide the formulation of alternative plans. The significant resources in the study area are also identified and form the basis for subsequent assessment of impacts of alternative plans.

2.01 National Objectives

Where a water and related land management project receives Federal assistance, it must address National Economic Development (NED) as the primary national objective. NED is achieved by increasing the value of the Nation's output of goods and services and/or improving the economic efficiency of producing these outputs. Although NED drives the project, Federal agencies are also directed to take into account the environmental impacts of the project and where possible, provide for the management, conservation, preservation, restoration, or improvement of the quality of natural and cultural resources within the project area. The NED planning objective is general and cannot be implemented directly. It can be achieved, however, by planning with objectives which reflect the opportunities and needs specific to the study area.

2.02 Study Area

The study area (see Figure 2) includes central San Francisco Bay from the Golden Gate Bridge in the west to the Oakland Bay Bridge in the south and to the Richmond - San Rafael Bridge in the north. Also included, but to a lesser level of detail are ocean areas outside the Golden Gate, nearshore land areas, an area north of the Richmond San Rafael Bridge which is a part of the authorized access route to the Richmond Long Wharf; and areas south of the Bay Bridge which are used by large vessels for anchorage and lightering operations.

The topography of adjacent land areas consists of hilly terrain used for a variety of purposes ranging from open space to densely populated metropolitan areas. Except for occasional fog, climate throughout the area permits year round efficient use of the navigation system. Winters are cool and rainy with periods of fog. Summers vary from warm and dry in the East Bay to cool and dry in the Golden Gate area. Annual precipitation consists almost entirely of winter rainfall which averages between 17 and 22 inches depending on location within the area. Waters of study area are oceanic. Tides during non-flood periods range from 5.8 to 0.(MLLW at the Golden Gate and from 5.9 to 0.1 MLLW in Central San Francisco Bay.

Within the study area there are two major ports, Richmond and San Francisco. Several anchorage areas, and three deepwater navigation channels used for access to ports south of the Oakland Bay Bridge (Oakland, Alameda, Redwood City) and to inland ports north of the Richmond-San Rafael Bridge are

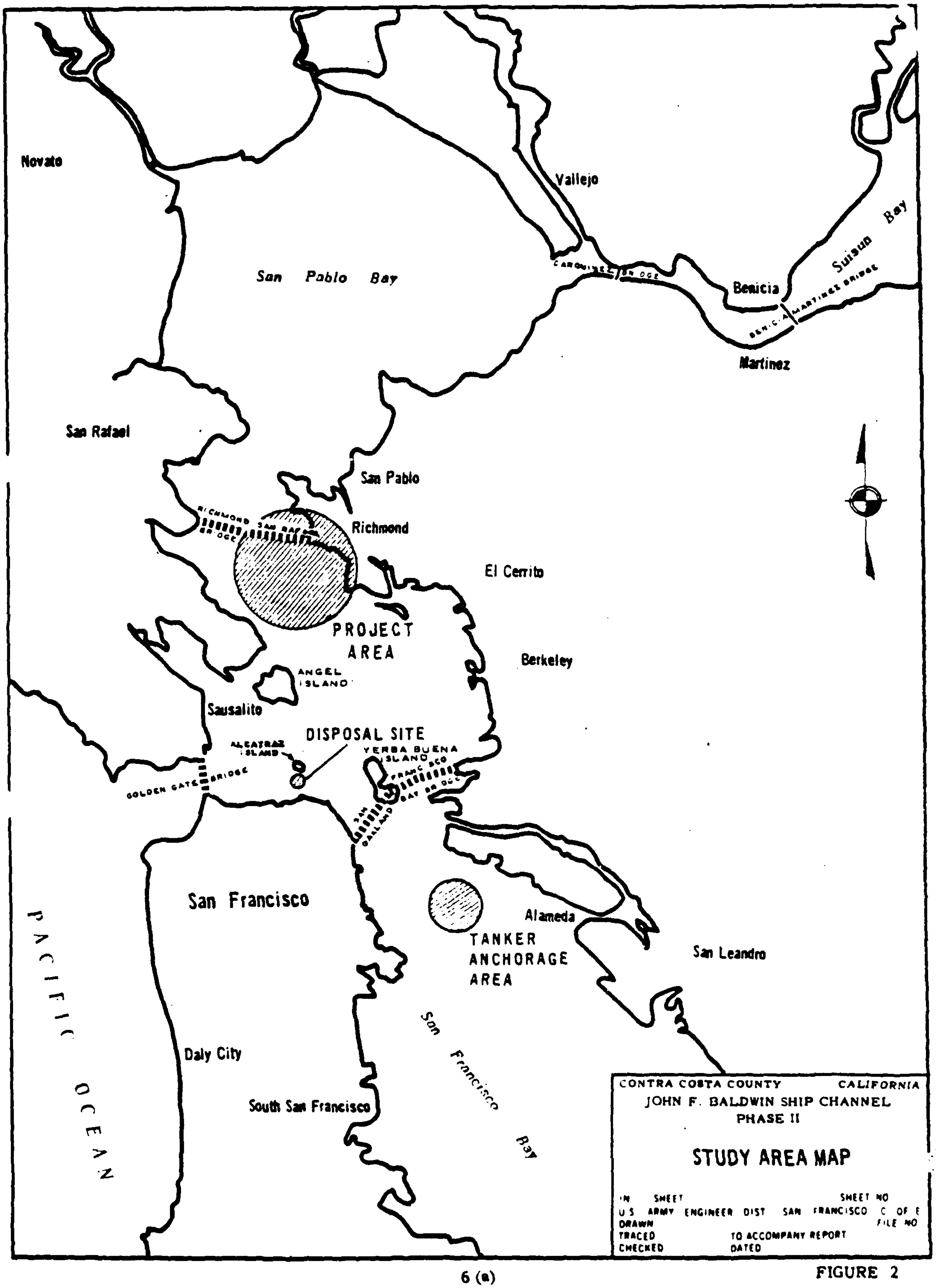

Novato
Vallejo
San Pablo Bay
Suisun Bay
Benicia
Martinez
San Rafael
San Pablo
Richmond
El Cerrito
PROJECT AREA
Berkeley
ANGEL ISLAND
Sausalito
DISPOSAL SITE
ALCATRAZ ISLAND
YERBA BUENA ISLAND
GOLDEN GATE BRIDGE
San Francisco
PACIFIC OCEAN
Alameda
TANKER ANCHORAGE AREA
San Leandro
San Francisco Bay
Daly City
South San Francisco
CONTRA COSTA COUNTY
CALIFORNIA
JOHN F. BALDWIN SHIP CHANNEL
PHASE II
STUDY AREA MAP
IN SHEET
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FIGURE 2

intimately associated with the Study Area. The terminal facility most directly affected by this study is the Chevron USA Richmond Refinery.. Other Chevron terminal facilities are located approximately 1.3 miles northeast of Point Richmond and south of the project area in Richmond Harbor.

Richmond Harbor is a Bay Area commercial port with petroleum and petroleum related products accounting for 75 percent of its total waterborne commerce. Tankers and containerships, as well as other craft, navigate through the in-bay shipping channels to reach Richmond. The nine-county Bay Area, is the second largest population center and marketing area on the Pacific Cost, and the seventh largest in the United States. International trade through the San Francisco Customs District has made the District the third largest on the West Coast. Most of the crude petroleum transported to Richmond is handled at Richmond Long Wharf which is operated by the Standard Oil Company. Sports such as fishing and boating afforded by the Bay, are of minor importance in the port area.

The shipping lane through the authorized West Richmond Channel and the Southampton Shoal Connecting Channel are in-bay shipping channels located west of Richmond Harbor. The Harbor is situated on the eastern side of San Francisco Bay, approximately 14 miles northeast of the Golden Gate Bridge. The West Richmond Channel extends for about 3 miles from deep water in central San Francisco Bay through the west navigation opening of the Richmond-San Rafael Bridge and into the deep water of San Pablo Strait just upstream of the bridge. Parallel and to the east of the lower end of West Richmond Channel is the Southampton Shoal Channel which provides a direct access to Richmond Harbor and the maneuvering area at the Richmond Long Wharf.

The maneuvering area adjacent to the Long Wharf is approximately 2,500 feet long alongside the face of the wharf and 2,000 feet across (perpendicular to the wharf) with depths ranging between 35 and 38 feet below MLLW. Maintenance dredging to -35 feet MLLW by the Corps of Engineers is authorized. Aids to navigation include lights at six locations at or near the perimeter of the maneuvering area. Access to the maneuvering area from the south is via the Southampton Channel and from the north through naturally deep water under the East Navigation opening of the Richmond-San Rafael Bridge.

2.03 Public Concerns

Concerns are public perceptions and desires which may be expressed directly, such as through correspondence or at public meetings, or indirectly through government representatives and agencies. Several concerns have been expressed by users regarding navigational difficulties associated with access to the Richmond Long Wharf Maneuvering Area. These concerns are summarized in the following paragraphs. Other concerns summarized below are those embodied in environmental legislation.

a. Navigational Efficiency. Tank vessel operators have stated that inefficient oil delivery methods are used due to insufficient depths to and in Long Wharf Maneuvering Area. Small or "light-loaded" vessels are often used for crude petroleum delivery to the Richmond refinery in order to gain access to the maneuvering area. This results in the need for a larger number of trips and a larger unit cost per barrel of oil delivered. Under current

shipping operations, fully loaded large vessels drop off part of their load at Standard Oil's refinery at El Segundo in Southern California before proceeding on to Richmond or enter the San Francisco Bay fully loaded and wait at deep anchorage while lightering vessels transfer the product to the refinery. Lightering operations are more time consuming and expensive than direct deliveries. The concern for navigational inefficiencies is reflected in the Congressional authorization for construction of deeper channels contained in Public Law 89-298.

b. Navigational Safety. Vessel and tugboat pilots have reported near-accidents resulting from the extremely sharp right turn made by vessels entering the maneuvering area via the southerly approach (Southampton Channel). Vessel handling is reportedly made difficult by the combination of cross-currents and slow-speeds necessary to make the turn. Other safety concerns voiced by the pilots relate to the difficulty of entering the maneuvering area from the north under ebb-tide conditions. The northerly approach involves transit through a narrow channel between Castro Rocks to port and the Richmond-San Rafael Bridge pier to starboard. The pilots do not attempt transit during periods which contribute to poor vessel controllability such as whenever the vessel must travel in the same direction as the current (ebb tide). Another safety consideration cited by pilots concerns vertical clearance under the east span of the Richmond-San Rafael Bridge. Pilots state that many large vessels are unable to clear the 135-foot (above mean higher high water) span.

c. Endangered and Threatened Species. The public concern for the preservation and protection of endangered and threatened species is reflected in the Federal Endangered Species Act of 1973.

d. Water Quality. The public concern for maintaining and enhancing water quality is reflected in the Clean Water Act of 1977, as amended. The objective of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters.

e. Wetlands. The public concern for maintaining and enhancing wetlands is reflected in Executive Order 11990 (Wetlands Protection). This policy states that Federal agencies should avoid to the maximum extent possible the long and short term adverse impacts associated with destruction or modification of wetlands. This public concern is reinforced by the Chief of Engineers Wetlands Policy and the State of California Wetlands Policy.

f. Ocean Environment. Public concern for the maintenance of a stable ocean environment is reflected in the Marine Protection, Research and Sanctuaries Act of 1972. This Act regulates the dumping and transportation for dumping of waste materials in the ocean so that no unreasonable degradation or endangerment shall occur to human health, welfare or amenities of the marine environment, ecological system and economic potentialities.

g. Inland Waters Environment. Public concern for protection of inland waters from the effects of disposal of waste materials is reflected in Section 404(b) of the Clean Water Act of 1977. This section mandates physical, chemical and biological evaluation of the waste materials and of the receiving inland waterways in order to minimize degradation of water quality and endangerment of ecological habitats.

2.04 Problems and Opportunities

Many of the public concerns are directly related to physical problems that can be solved through water and related land resources management. While the evaluation of public concerns reflects the range of needs perceived by the public, the problems, and opportunities addressed in the following paragraphs are established on the basis of technical and professional analysis.

a. Navigation Efficiency. Current fleet operations include the direct shipment petroleum from Alaska to the Richmond Long Wharf with 80,000 DWT and 120,000 DWT tankers with lightering in San Francisco Bay. Current shipments of Indonesian petroleum are through El Segundo utilizing 150,000 DWT tankers with lightering in San Francisco Bay. The extensive use of lightering vessels for delivering petroleum from Anchorage Nine in the South Bay to the Richmond Long Wharf represents an economic inefficiency.

To analyse the economic impacts of channel deepening, an idealized fleet composition was determined by minimizing transportation costs as explained in Appendix A. An assumed ideal fleet composition for the existing channel configuration is used for economic evaluation rather than the actual fleet composition since it then can be compared to an idealized fleet composition which would result from an improved navigation channel. The idealized fleet composition for the existing channel configuration is shown below:

Vessel Size (DWT)	SOURCE	ROUTE
140,000 with 2 Lightering Vessels	Alaska	Direct
150,000 with 2 Lightering vessels	Indonesia	Indirect via El Segundo

This is very similar to the current fleet operations with the exception that 120,000 and 80,000 DWTs are used from Alaska. This supports the idea that shippers do attempt to use the most efficient vessels given the constraints imposed by any particular route. Differences between the actual and the idealized fleet composition are largely attributable to differences between the company's true operating costs and the operating cost data prepared on a nationwide basis 1/, especially differences in the costs associated with lightering. In San Francisco Bay lightering is primarily the result of inadequate in-bay channel depths. If for example, the cost for the lightering vessels in the nationwide data were increased in the economic analysis, there would be a tendency to reduce the amount of lightering by employing smaller primary tankers. This tendency appears to be reflected in the actual fleet carrying petroleum from Alaska. Other reasons exist for the variation between actual and the assumed "ideal fleets" such as timing, current ship availabilty and the cost of investment. These reasons are discussed in Appendix A, Economic Evaluation.

1/ Estimated Annual U.S. and Foreign Flag Deep Draft Vessel Operating Cost, U.S. Army Water Resources Support Center, Corps of Engineers, July 1981.

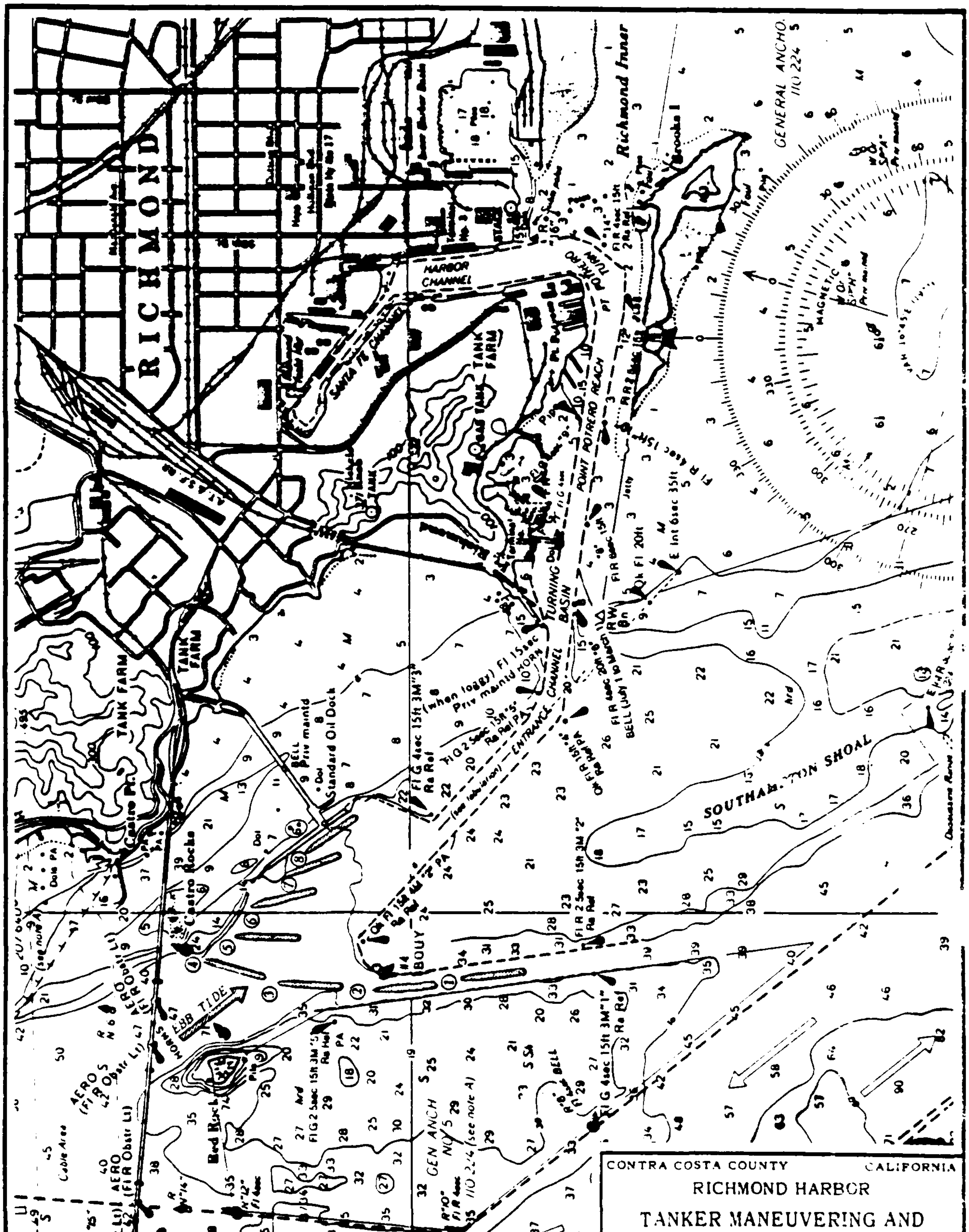
b. Navigation Safety. Tidal currents at the northern end of the maneuvering area average 1.3 knots at maximum flood and 1.4 knots at maximum ebb, while the tropic (average monthly maximum) values are 1.9 knots and 2.4 knots, respectively.

Current directions are 320° (flood) and 175° (ebb) from true North (0°). These conditions coupled with orientation of the Richmond Long Wharf make navigation by large tank vessels from the southerly approach difficult. The northerly approach to the Richmond Long Wharf (from the West Richmond Channel) has the problems of clearance under the east navigation opening of the Richmond San Rafael Bridge and vessel controllability under ebb tide conditions. A survey of mast heights of tank vessels calling at the Richmond Long Wharf shows that most vessels larger than 100,000 DWT are unable to clear the 135' vertical clearance height of the east navigation opening. Vessels which are able to clear the bridge, experience difficult control problems during an ebb tide because a following current is pushing them at a time when they must slow down and turn to Long Wharf. This situation has prompted Standard Oil to prohibit the use of the northerly approach by Chevron ships during ebb tides.

Most pilots consider the southerly approach (from the Southampton Channel) to be the safest route to the Long Wharf and Richmond Harbor under all conditions. This route, however, is not without its problems. Special maneuvering and berthing procedures are required for ships to reach the Richmond Long Wharf. These procedures are shown on Figures 3 and 4. Particularly troublesome, is the berthing maneuver during flood tide. The orientation of the Southampton Channel is approximately 173° clockwise from true North while the orientation of the Long Wharf is 145° clockwise from true North. A vessel attempting to berth during a flood tide therefore, must make a relatively sharp turn (152°) across the manuevering area to come in line with the Long Wharf.

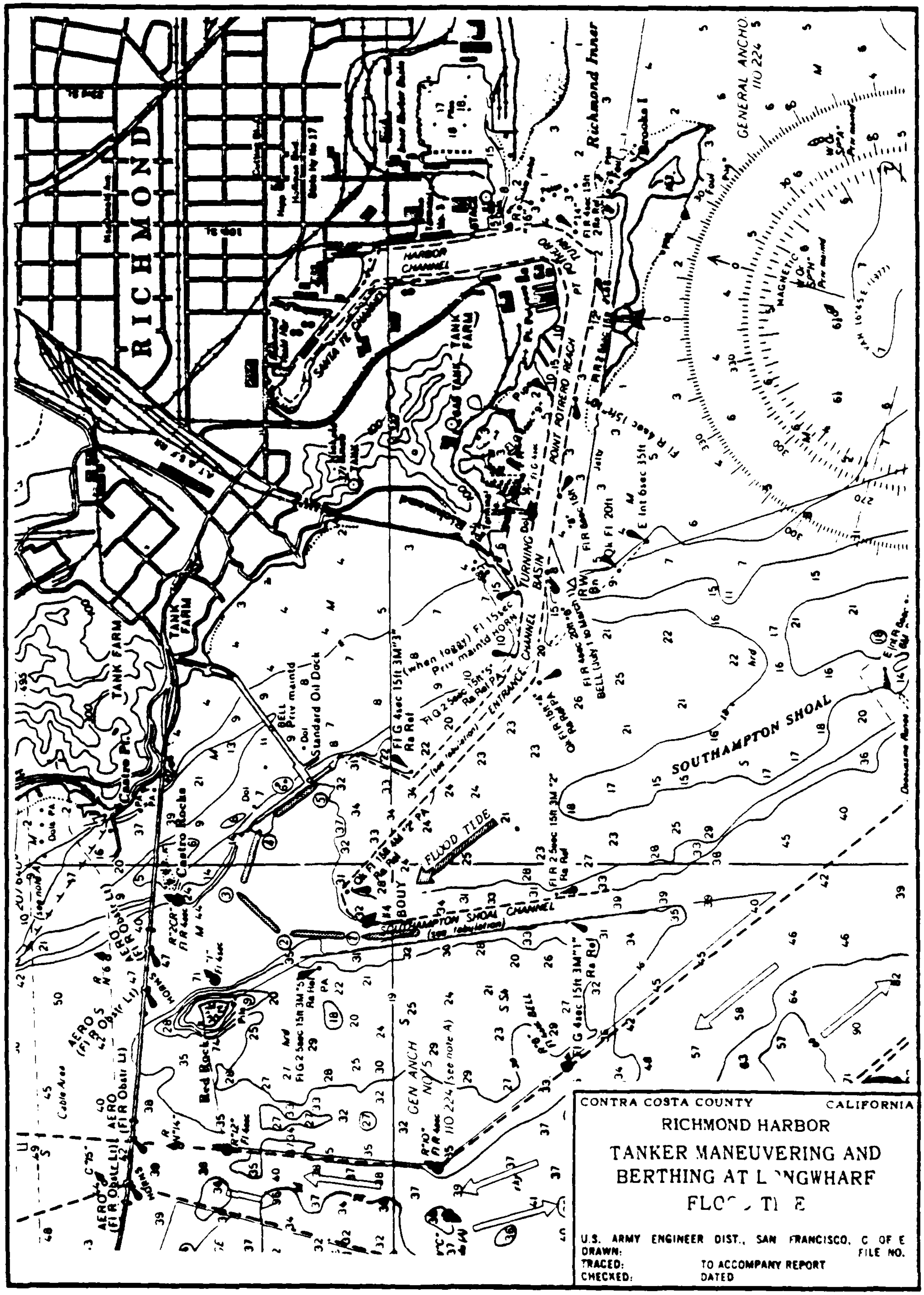
c. Other Port of Richmond Traffic. In addition to Richmond Long Wharf traffic, the Maneuvering Area and access channels are used by commercial vessels and pleasure craft in transit to and from Richmond Harbor. The Port of Richmond has terminal facilities south of the Long Wharf for break bulk, container, dry bulk and liquid bulk cargo. Local plans exist for improving railroad and highway access to the port and for increasing container storage capacity and number of containership berths. A Corps of Engineers Feasibility Report[2/] recommends deepening the harbor and access channels to 41 ft. MLLW from the existing 35-foot depth. Deepening the channel and harbor would result in economies of scale accruing to existing traffic and would also stimulate future traffic and permit the realization of port development plans. Improvements made as a part of this John F. Baldwin project would result in partial implementation of improvements recommended in the Richmond Harbor Feasibility Report.

2/ Richmond Harbor California, Deep Draft Navigation Improvements, Feasibility Report, Corps of Engineers, San Francisco District, September 1981.



RICHMOND
TANK FARM
HARBOR CHANNEL
SANTA FE CHANNEL
TURNING BASIN
ENTRANCE CHANNEL
POINT POTRERO REACH
Richmond Inner
EBB TIDE
Red Rock
Castro Rocks
Standard Oil Dock
GEN ANCH
CONTRA COSTA COUNTY CALIFORNIA
RICHMOND HARBOR
TANKER MANEUVERING AND BERTHING AT LONGWHARF
EBB TIDE
DRAWN:
TRACED:
CHECKED:
FILE NO.
DATED

FIGURE 3



CONTRA COSTA COUNTY CALIFORNIA

RICHMOND HARBOR

TANKER MANEUVERING AND BERTHING AT L NGWHARF

FLO TI E

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E

DRAWN: FILE NO.

TRACED: TO ACCOMPANY REPORT

CHECKED: DATED

FIGURE 4

2.05 Environmental Considerations

This subsection outlines some of the environmental considerations which are taken into account in planning the project. The resources described are considered important because they are identified in laws, regulations, guidelines, or other institutional standards of national, regional, local, public or private agencies. Navigation efficiency and safety considerations have been discussed previously. Environmental considerations in the study area include:

a. Endangered and Threatened Species. Nine endangered or rare animal species or sub-species may be found in the San Francisco Bay Area. None of these species are known to inhabit the Richmond Harbor area. No endangered or threatened plant species are known to be found in the area. (See Appendix C, Fish and Wildlife Coordination)

b. Air Quality. In 1981 the San Francisco District performed an air quality analysis for the Richmond Harbor (including the Richmond Long Wharf) when considering deep-draft navigation improvements for that area [3/]. This analysis showed that air quality in Richmond generally is "good", and that while dredging would have a short-term impact on air quality conditions, no significant changes in future air quality conditions were identified with or without the project.

c. Water Quality. Water Quality is a significant resource based on the concerns of the Clean Water Act (CWA) as amended in 1977 and the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972., Water quality parameters are directly related to the interaction of sediment and water at the dredging and disposal sites under consideration. Water quality parameters of concern include: dissolved oxygen concentrations, suspended solids, heavy metals, petroleum hydrocarbons, and pesticides.

Sediment quality analyses, bioassays and bio-accumulation studies showed that bottom materials from the West Richmond and Southampton Shoal Channel consisted primarily of sands and are therefore considered inert. (See Appendix B for Analysis of Sediments)

The bottom material from the Maneuvering Area contain a greater proportion of silt and therefore were tested to determine their disposition in the biological community during dredging and disposal. The result of the bioassay concluded that fish would not be exposed to concentrations of dredged material great enough to cause significant mortality due to any biologically active constituent. The bio-accumulation results revealed no significant uptake of cadmium, copper, lead, mercury, zinc, chlorinated hydrocarbons, petroleum hydrocarbons and polychlorobiphenyls by the test species, Japanese littleneck clam. (See Appendix B for bio-accumulation report)

3/ Richmond Harbor Feasibility Report, Appendix K, Corps of Engineers, San Francisco District, 1981.

d. Wetlands and Intertidal Areas. Existing wetlands in or near the study area occur at Emeryville, Point Isabel, Brooks Island and North Richmond. Both Federal and State policies declare wetlands to be vital areas constituting productive and valuable public resources and discourage, as contrary to the public interest, their alteration or destruction.

Intertidal flats rim most of San Francisco Bay. In the study area important intertidal areas exist along east shore Emeryville, Richmond and Brooks Island. Intertidal flats support diverse invertebrate faunal assemblages which provide nursery and feeding areas for a variety of shorebirds, waterfowl and fish including a number of game species. Although intertidal areas are not vegetated, they essentially hold the same public resource values as vegetated, wetlands. No wetland or intertidal areas will be directly impacted by any project alternative.

e. Benthos. This subtidal resource is considered significant because of its role in the aquatic food web. Both alternative channel areas and the general area of the disposal site contain this resource and all would be directly impacted. This resource consists primarily of invertebrate organisms including worms, crustaceans, and assorted mollusks. These small bottom-dwellers are food for larger vertebrates aquatic life. Several areas adjacent the Richmond Harbor area are considered potential shellfish seeding areas. With annual maintenace dredging of existing channels, community stability of benthic life is limited. Shoaling of excavated channel bottoms also contributes to an unstable community in the channel bottom. Studies [4/] conducted throughout the Bay specifically for dredging and disposal activities, have shown that recolonization occurs in the dredged areas. This recolonization indicates the resiliency of the benthos to re-establish after disturbance.

f. Energy. Related to efficient use of the navigation channels by commercial vessels is energy consumption. Energy resources have assumed greater economic and environmental values due to increasing demand and higher costs. The present national concern for conservation of energy resources has application to efficient navigation use and is treated as a significant resource. The measurement of this resource can be indicated by savings realized from the reduction of tidal delays and lightering activities, a part of the commercial shipping benefits.

2.06 Planning Objectives

Improvements in navigation supported by Federal funding must be in the Federal interest and must be accessible to all users on equal terms. Since this project serves one user, the problem of equal access does not occur. However, the improvements must contribute to the overall national objective of Federally funded water and related land resources planning; namely: National Economic Development (NED). This national objective establishes the framework

4/ Dredge Disposal Study - San Francisco Bay and Estuary, Corps of Engineers, San Francisco District, February 1977.

for planning a Federal water resources development project. Planning objectives derived through analysis of public concerns and significant resources of a specific study area, are set within this framework and form the basis of the study. Concern has been expressed during the conduct of this study for the improvement of efficiency (and safety) of waterborne transportation of crude petroleum in Central San Francisco Bay. Technical investigations and analysis indicate that existing channel depths limit the size of crude petroleum loads which can be safely transported to a major oil terminal in the Central Bay, which results in economically inefficient shipping procedures of Federal concern.

As a result of the analysis of the public concerns and problems and opportunities of this study area, the following planning objectives are derived and employed in the plan formulation section:

Navigation Efficiency.

To improve the efficiency of navigation of Central San Fancisco Bay in the transportation of foreign and interstate crude petroleum for the period 1985 to 2035 is the first objective.

Navigation Safety.

To improve the safety margin for navigation of tanker vessel traffic using Central San Francsico Bay for the period 1985 to 2035 is the second objective.

2.07 Planning Constraints

Planning constraints are overriding concerns that must be considered in the development of plans. Planning constraints reflect the combination of expressed public concerns and the actual existence of a significant resource related to that concern. Planning constraints may not be bartered or exchanged in the planning effort. The planning constraints for this study are:

a. Wetlands. There is a need to avoid adverse impacts on wetlands to comply with Executive Order 11990, Protection of the Wetlands. This Order directs Federal agencies to provide leadership, to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. This policy states that agencies should avoid to the extent possible the long and short-term impacts associated with modification or destruction of wetlands. The agency shall also avoid undertaking and providing support for new construction, including dredging, channelizing, filling, diking, impounding and related activities located in wetlands, unless the agency head finds: (1) no practical alternative and (2) all practical measures have been taken into account including economic, environmental and other pertinent factors. Wetland areas exist within the San Francisco Bay Area. Because of this constraint, no project actions were considered which would impact wetlands.

b. <u>Dredge Material Disposal.</u> The need for the proposed dredging and acceptable disposal activities are established. Land disposal sites were eliminated due to lack of available area in nearby locations. As a result, only aquatic disposal of dredged material is considered in this study.

The discharge of dredged or fill material into waters of the United States requires compliance with the Environmental Protection Agency's interim final guidelines (40 CFR 230.4 and 230.5), which regulate all discharges of dredged or fill material under Section 404 of the Clean Water Act. These "404b guidelines" provide a general approach for EPA and the Corps of Engineers to evaluate discharges of dredged or fill material. The procedures used by the San Francisco District under 404b to determine the suitability of dredged material for aquatic disposal are contained in Public Notice No. 78-1 (See Appendix B) issued by the District Engineer on 30 July 1979. These procedures are used in conjunction with EPA's 1975 guidelines (40 CFR 230 and the Corps regulations 33 CFR 320-329, 19 July 1977), to evaluate potential aquatic impacts of discharges at open-water sites within the District.

Public Notice 78-1 specifies procedures for evaluating the discharge of silt dredged material by elutriate analysis of the dredged material mixed with the disposal site water. The elutriate data is then compared to established water quality objective after dilution within the permissible mixing zone of the disposal area has been taken into account. If the concentration of one or more of the contaminants would exceed the water quality objective after dilution, a suspended particulate phase bioassay is required to determine actual impact. Otherwise the dredge material is considered suitable for aquatic disposal without further testing.

Because of this constraint extensive sediment quality testing was required for in-bay disposal. (See Appendix B for 404b Evaluation)

SECTION 3

PLAN FORMULATION

Plan formulation, the heart of the planning process, consists of the development of resource management measures which could be used to address the planning objectives identified in the preceding chapter, Problem Identification. Plan formulation develops a range of possible management measures; conducts a preliminary assessment of the impacts of these measures; screens out various measures on the basis of an evaluation of their impacts; and combines the remaining measures into detailed plans for further evaluation. The candidate plans which are the outputs of plan formulation are described at the end of this Chapter.

3.01 Alternative Management Measures

Water and related land resources may be managed by a wide variety of technical and institutional means. Several management measures could be used to address the specified planning objectives. A range of management measures are examined to identify those which, alone or in combination, could address one or more of the planning objectives. These management measures are the "building blocks" or plan components which can subsequently be developed into alternative plans. All appropriate measures are identified including those proposed or suggested by different interest groups. The types of management measures which could be employed are described in the following paragraphs. The advantages and disadvantages of each are also discussed.

a. No Federal Action. This alternative assumes that no new project would be built to facilitate the transportation of crude petroleum to the Richmond Long Wharf. Large Standard Oil tankers would continue to navigate from deep-water in San Francisco Bay to lightering areas in the South Bay and would then reach the Long Wharf via Southampton Shoal Channel. Existing ship channels and maneuvering areas would continue to be maintained at existing -35 feet (MLLW) depths. Refinery through-put, over the next 50 years, would be as shown on Table 2 below.

TABLE 2

ACTUAL & PROJECTED CRUDE OIL DELIVERIES
RICHMOND
Barrels/Calender Day

	1981	1985	1995	2005-35
Alaskan	120,000	122,400	128,600	135,000
Indonesian	25,000	25,500	26,800	28,000
Domestic	136,000*	136,000	136,000	131,000
Total Production	281,000	284,000	291,000	294,000
Capacity	294,000**	294,000**	294,000**	294,000**

* Estero mix - 24,000; Pipeline - 112,000; total expected to ultimately travel entirely by pipeline.

** Actual capacity is 365,000 but held to 294,000 because of Air Control Board restrictions.

Source: Industry spokesmen.

Petroleum demand projections are assumed to be independent of the refinery's ability to transport petroleum efficiently and would be realized irrespective of the alternative selected.

b. Central Terminal near Treasure Island.[5/] This alternative would entail construction of fixed berths west of Treasure Island, with pumping equipment and underwater pipelines for transportation of petroleum to storage tanks at the Richmond refinery (see Figure 5). The first costs of berthing structures sufficiently large to accommodate tankers up to the size which can navigate the San Francisco Bar at existing depths, exclusive of pipelines, and pumps, is estimated at $790 million. This estimated cost exceeds the costs for the dredging alternatives by a substantial amount. There is no indication of support for this alternative by the potential users and there are no obvious environmental advantages which would result from its implementation.

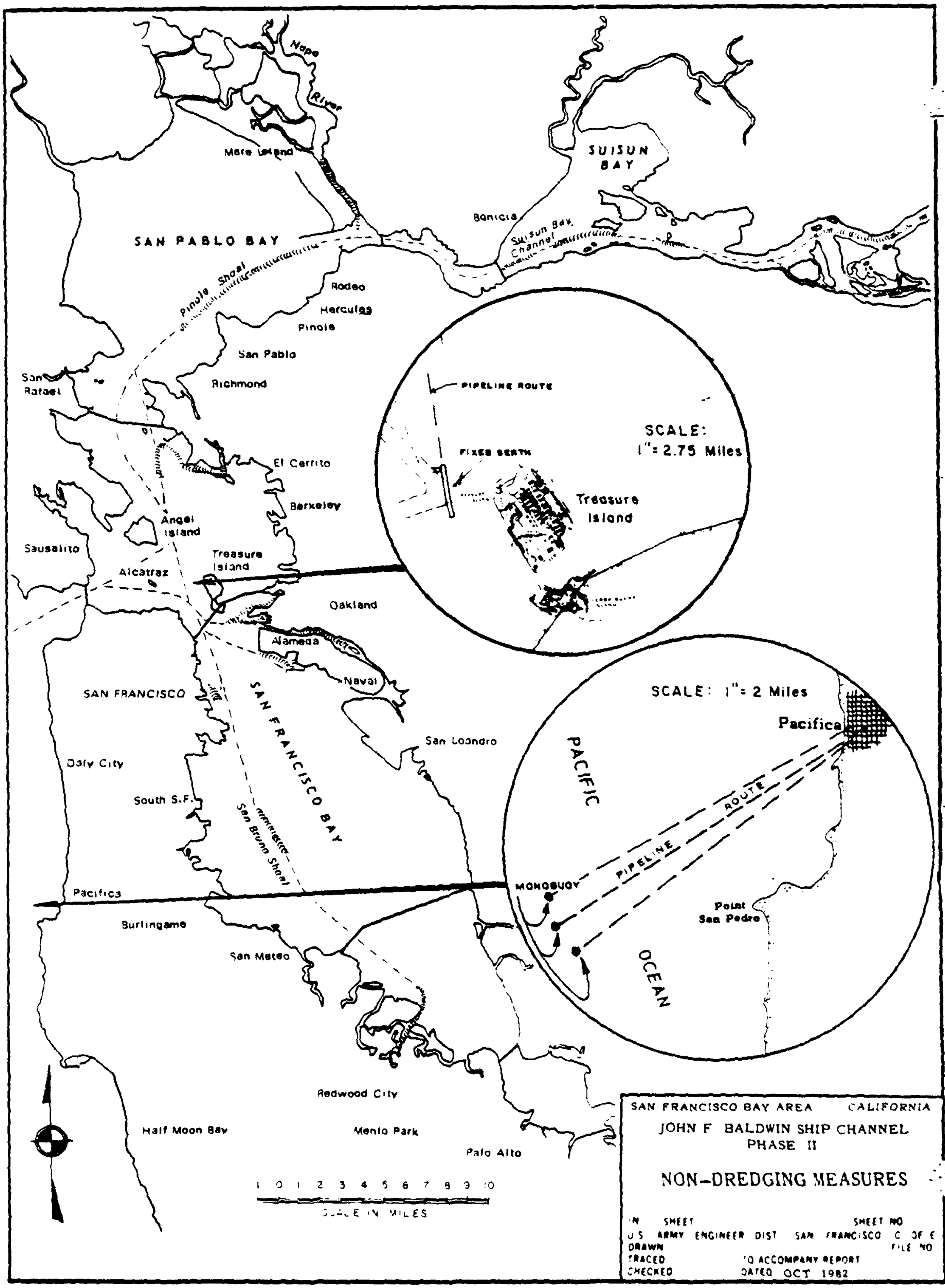
c. Monobuoy Off Golden Gate/Pacifica.[5/] This alternative consists of monobuoys anchored in deepwater approximately three miles offshore of Pacifica, California where tankers of any size could be accommodated (see Figure 5). The crude oil would be conveyed to a storage facility in the City of Pacifica by pipelines. From this storage facility, oil would be pumped to Richmond and to other refineries in Contra Costa and Solano Counties. The cost of a monobuoy to accommodate 250,000 DWT tankers (chosen as a representative large vessel) is estimated at $1.4 billion, exclusive of storage facilities and the work required to transfer the oil to Contra Costa County.

This partial cost easily exceeds the total estimated cost of the dredging alternatives. There is no indication of support for this alternative by the potential users and there are no obvious environmental advantages which would result from its implementation.

d. West Richmond Channel (WRC) Dredging. The West Richmond Channel between Black and White Buoy "C" and deep water north of the Richmond-San Rafael Bridge and the Richmond Long Wharf Maneuvering Area would be dredged to -45 MLLW as authorized in 1965. Vessels bound for the Richmond Long Wharf would proceed north through the channel and under the west navigation opening of the Richmond-San Rafael Bridge, then make a U-turn to starboard and return under the east navigation opening of the bridge to enter the Maneuvering Area (See Figure 6).

There are two major drawbacks to this alternative. First, there is the matter of hazards to navigation, namely the bridge and rocks (Castro Rocks and Red Rock) which become especially prominent when navigation is attempted during ebb tide. Reduced vessel maneuverability on ebb tide approaching the east navigation opening of the bridge could result in a major accident involving the bridge or rocks. The second drawback is the clearance under the east span of the bridge, the height of which is limited to 135 feet above mean higher high water. Vessels of the 100,000 DTW and larger class can not clear the bridge at high tide. If under this alternative larger vessels could not use

5/ West Coast Deepwater Port Study, North Pacific Division/South Pacific Division , Corps of Engineers, 1976.



Napa River
Mare Island
SUISUN BAY
Benicia
Suisun Bay Channel
SAN PABLO BAY
Pinole Shoal
Rodeo
Hercules
Pinole
San Pablo
San Rafael
Richmond
El Cerrito
Berkeley
Angel Island
Sausalito
Treasure Island
Alcatraz
Oakland
Alameda
Naval
SAN FRANCISCO
SAN FRANCISCO BAY
San Leandro
Daly City
South S.F.
San Bruno Shoal
Pacifica
Burlingame
San Mateo
Redwood City
Half Moon Bay
Menlo Park
Palo Alto
SCALE IN MILES
PIPELINE ROUTE
FIXED BERTH
SCALE: 1" = 2.75 Miles
Treasure Island
SCALE: 1" = 2 Miles
Pacifica
PACIFIC
OCEAN
MONOBUOY
PIPELINE ROUTE
Point San Pedro
SAN FRANCISCO BAY AREA CALIFORNIA
JOHN F BALDWIN SHIP CHANNEL
PHASE II
NON-DREDGING MEASURES
U.S. ARMY ENGINEER DIST SAN FRANCISCO C OF E
TO ACCOMPANY REPORT
DATED OCT 1982

FIGURE 5

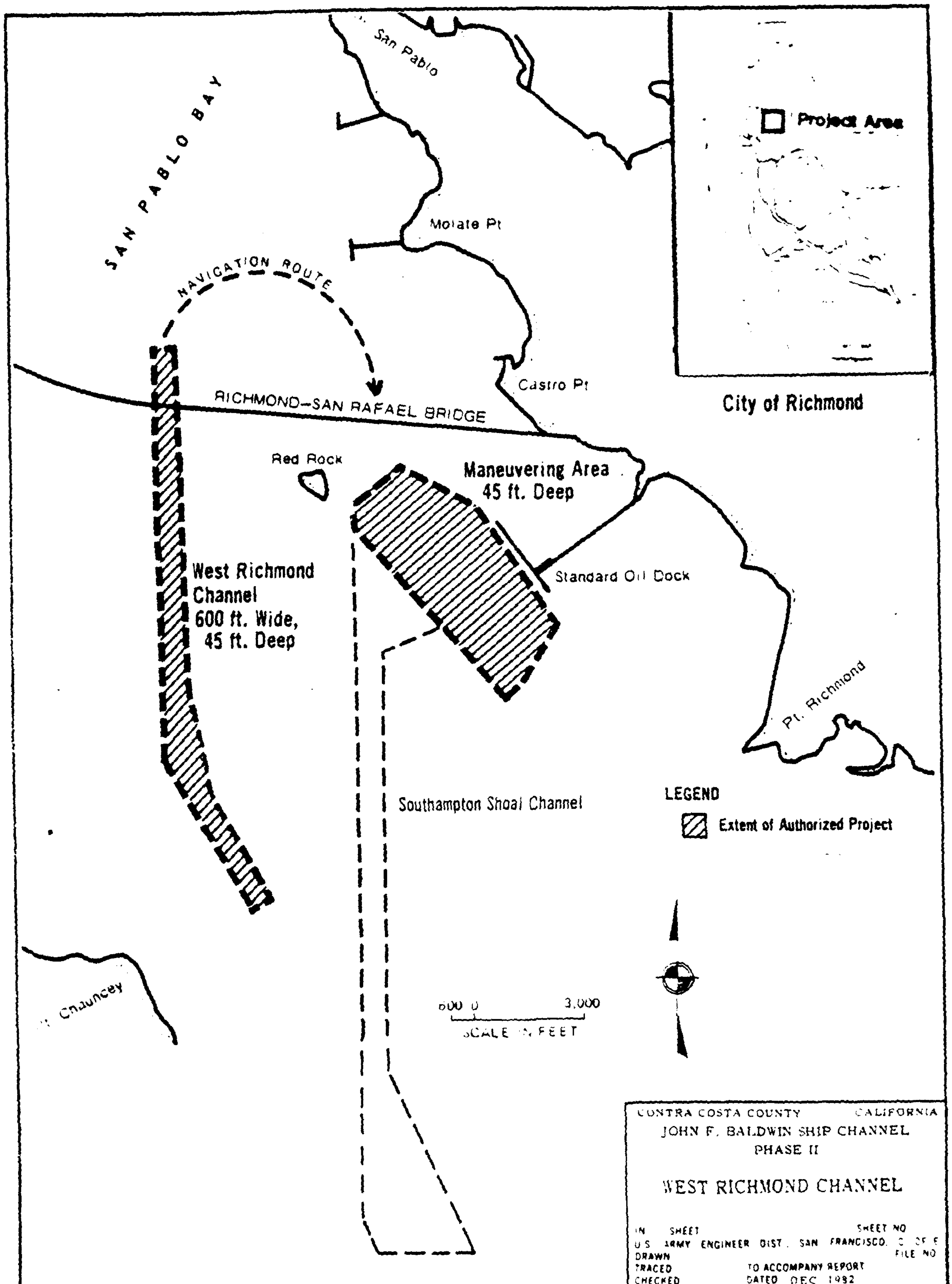

San Pablo
SAN PABLO BAY
Project Area
Molate Pt
NAVIGATION ROUTE
Castro Pt
City of Richmond
RICHMOND–SAN RAFAEL BRIDGE
Red Rock
Maneuvering Area
45 ft. Deep
West Richmond
Channel
600 ft. Wide,
45 ft. Deep
Standard Oil Dock
Pt. Richmond
Southampton Shoal Channel
LEGEND
Extent of Authorized Project
Chauncey
600 0 3,000
SCALE IN FEET
CONTRA COSTA COUNTY CALIFORNIA
JOHN F. BALDWIN SHIP CHANNEL
PHASE II
WEST RICHMOND CHANNEL
SHEET NO
U.S. ARMY ENGINEER DIST., SAN FRANCISCO
FILE NO
DRAWN
TRACED
TO ACCOMPANY REPORT
CHECKED
DATED DEC 1992

FIGURE 6

the route because of bridge height limitations, and all other vessels would not use the route during ebb tide because of navigation risks, the actual benefits associated with access to the Richmond Long Wharf of a deepened West Richmond Channel would be negligible.

e. Southampton Shoal Channel (SSC) Dredging. By this measure (see figure 7) the Southampton Shoal Channel and Richmond Long Wharf Maneuvering Area, which are currently maintained at -35 feet MLLW would be dredged to a depth of -45 feet MLLW. The Southampton Shoal Channel is the preferred route by users for access to the Richmond Long Wharf, because it is a more direct and less hazardous route than the West Richmond Channel. Dredging the Southampton Channel, however, is a larger job than dredging the West Richmond Channel. Increased dredging quantities are due to the flaring of the channel ends and the fact that there are no naturally deep areas in the channel.

3.02 The four management measures discussed above were screened by applying the four tests of: functional effectiveness, public acceptability, economic efficiency and completeness. The summary of this first screening process is shown on Table 3 below. The No-Action measure is not included in this initial screening because it is always considered a viable measure and should be considered through-out the study process. As a result of this screening process the Treasure Island Terminal and Ocean Monobuoy management measures are dropped from further consideration in this study, on the basis of high costs, large scope of impacts and no local support. The West Richmond Channel dredging is also dropped from further consideration because it does not meet the planning objectives and it is not supported by the Richmond Harbor users. Dredging the Southampton Shoal Channel appears to be the only alternative to pass the four tests and therefore it is carried forward along with the no-action alternative for further analysis.

TABLE 3
SCREENING OF MANAGEMENT MEASURES

T MEASURE ST	TI TERMINAL	OCEAN MONOBUOY	WRC DREDGING	SSC DREDGING
NCTIONAL FECTIVENESS	Provides deepdraft facilities. Requires additional trans. facilities	Provides deepdraft facilities. Requires additional trans. facilities	Provides limited deepdraft access to existing facilities	Provides deep-draft access to existing facilities
BLIC CEPTABILITY	Land and water impact: No Local Support	Land and water impact: No Local Support	Water quality impacts, Partial local support	Water quality impacts, Local Support
ONOMIC FICIENCY	Cost $790M	Cost $1390M	Cost $30M (Clamshell 1982 $)	Cost $42.5M (Hydraulic 1984 $)
MPLETENESS	Meets planning objectives but	Meets planning objectives	Does not meet objectives	Meets plannin objectives

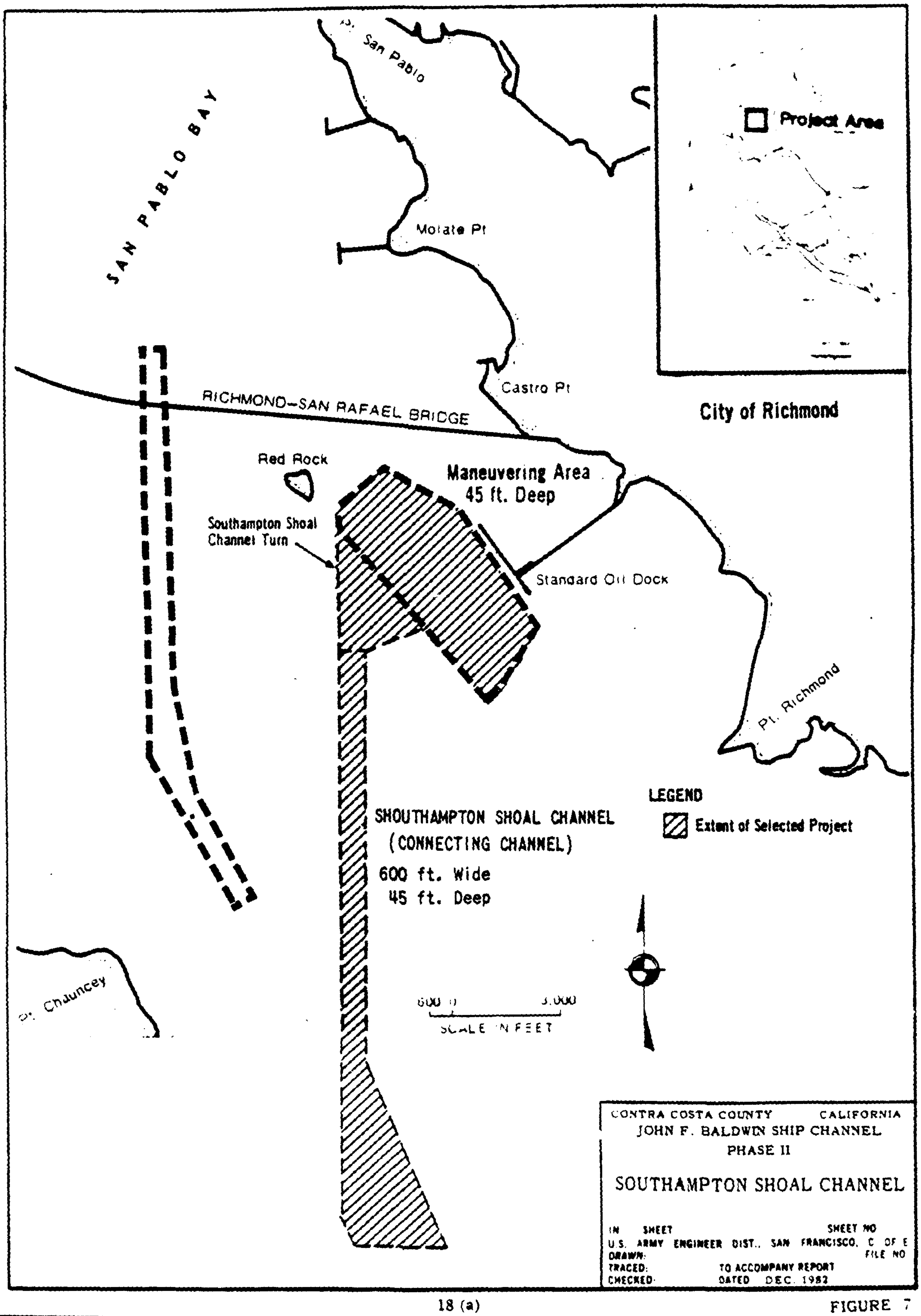

Pt. San Pablo
SAN PABLO BAY
Molate Pt
Castro Pt
RICHMOND-SAN RAFAEL BRIDGE
Project Area
City of Richmond
Red Rock
Maneuvering Area
45 ft. Deep
Southampton Shoal
Channel Turn
Standard Oil Dock
Pt. Richmond
LEGEND
Extent of Selected Project
SHOUTHAMPTON SHOAL CHANNEL
(CONNECTING CHANNEL)
600 ft. Wide
45 ft. Deep
Pt. Chauncey
SCALE IN FEET
CONTRA COSTA COUNTY CALIFORNIA
JOHN F. BALDWIN SHIP CHANNEL
PHASE II
SOUTHAMPTON SHOAL CHANNEL
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
TO ACCOMPANY REPORT
DATED DEC. 1982

FIGURE 7

3.03 Dredging Management Measures.

a. Hopper Dredge. The hopper dredge is a self-propelled ocean-going vessel which removes material from the bottom of the bay or ocean by scraping and sucking through pipes known as drag pipes, which are trailed on the sides of the vessel. The dredged material is pumped into bins or hoppers in the vessel, from which it can be discharged by bottom dumping. Because of its size, the hopper dredge disturbs bottom sediment as it moves. However, this occurs with any deep-draft vessel. The cutting motion of the dredge also disturbs sediments. During loading, overflow periods return sediments to the water column. The dredging activity does not have a detectable long-term effect on water quality. The use of hopper dredges is dependent upon availability. The availability of privately-owned hopper dredges in the San Francisco Bay area is limited, but a hopper dredge may bid the job.

b. Clamshell Dredge and Barge. The clamshell dredge removes sediment by a bucket which is dropped through the water and is then worked into the sediment. The bucket is raised and dumped into a barge, which when full carries the sediment to the disposal site where it is discharged by bottom dumping or direct pumpout. Turbidity occurs as the clamshell bucket bites into the sediment and breaks free when it is hoisted. The bucket also loses sediment as it is lifted through the water and as it breaks free of the water surface and is swung to the barge. Consolidated material tends to remain in mass when disposed and would remain consolidated through the water column, even at high energy disposal sites. Material breakdown would depend upon plasticity of the sediments or liquid content and the current velocities generated by tidal influence, which would affect the rate in which the sediment is able to break apart and disperse. This dredging method was the assumed dredging method presented in the draft report. Clamshell dredging will be permitted only if disposal can be done in slurry as subsequently discussed.

c. Hydraulic Dredge. Hydraulic pipeline dredges remove bottom sediment by sucking and pumping through a pipeline. This removal process yields a product different from the in-place sediment removal by a clamshell dredge, because in removing sediment the suction dredge requires water to form a slurry mixture. The hydraulic cutterhead suspends the least amount of sediment per dredge activity. Materials can be transported by barge or by pipeline as far as two or three miles with dredge pumps alone, and farther with remote booster units. The length of a fixed or temporary pipeline could be a hazard to navigation over long distances and will have significant adverse effects in heavily used designated aquatic disposal site in heavily used channels. Barge transport and dump at the Alcatraz Disposal Site in conjunction with this alternative measure, was assumed to form the basis for estimating the cost for the project. The high rate of production was also a beneficial factor in assuming this method.

3.04 Disposal Management Measures.

a. 100-Fathom (Ocean). The site (SF 7) is located south of the Farallon Islands at Latitude 37°31'45"N and Longitude 122°59'00"W, 29.6 nautical miles from the Golden Gate. This site is located within the Farallon Islands Marine Sancturary. The depth is 100 fathoms, or 600 feet. This site had been

generally considered when use of land or bay aquatic disposal sites were precluded. Determination to use this site is on a case-by-case basis in accordance with ocean dumping criteria, 40 CFR 227-228. Mixing characteristics are not as pronounced as other sites. Increased bottom turbidity and associated dissolved oxygen depression have the potential to smother benthic organisms at the site. The long distance from the project area would significantly increase the amount of fuel used, versus other disposal methods.

b. S.F. Channel Bar (Ocean). This site (SF 8) is parallel to and 6,000 feet south of the San Francisco Bar Channel five miles outside the Golden Gate. The site is used for maintenance disposal of sand. Placement of silty-clay at the site could result in longer periods of turbidity. Increased bottom turbidity and associated dissolved oxygen depression have the potential to smother benthic organisms at the site. However, organisms inhabiting the Bar are generally evolved for efficient locomotion and the ability to escape sustained burial. The expected dissimilarity between bottom sediments of this site and Bay sediments may result in a greater potential for adverse bottom impacts. The long distance to the channel bar site, although less than to the 100-fathom site, would also significantly increase the fuel consumption of the dredging project, versus use of disposal sites situated in closer proximity to the project site.

c. Bay Disposal. There are presently three Bay aquatic disposal sites designated as suitable for dredged material disposal. Carquinez Strait (SF 9) is 0.8 nautical miles from Mare Island Straits entrance; San Pablo Bay (SF 10) is 2.6 nautical miles northeast of Point San Pedro; Alcatraz (SF 11) is about 0.3 nautical miles south of Alcatraz Island.

Due to the distance of SF 9 and 10 from project area, and the closer proximity of SF 11 to the Golden Gate Bridge, the Alcatraz Site has been selected for further evaluation. It is preferable environmentally. The site is characterized as a deep, high energy area, dynamic both physically and biologically. Material dispersion of unconsolidated sediments would occur within several minutes. Associated with sediment disturbance are certain temporary chemical changes in the water column. Since Bay mud is typically in an oxygen deficient state, oxygen is taken from the water column when the sediment is resuspended during disposal. This oxygen reduction in the water is localized at the disposal site and is short-lived. Toxic substances also associated with Bay sediments have not been found to be readily released from sediment attachment and into the water column. To insure environmentally safe disposal at this site, extensive water quality analyses are required.

Although Alcatraz disposal site is considered a high energy area characterized by high currents and scouring of the bottom, a dredge material mound has developed in the eastern half of the site (Figure 8). The area of the mound only occupies about 20 percent of the designated disposal area (bottom surface). This mound has apparently been formed by unauthorized disposal of concrete rubble in association with consolidated dredged sediments, which have not quickly eroded with the strong currents. The size of the mound has been monitored and it is being eroded. Corrective action will be taken before the end of the 1984 calendar year, independent of the proposed channel improvements to enhance the erosion process. The Alcatraz

ALCATRAZ DISPOSAL SITE
9 JAN 1983

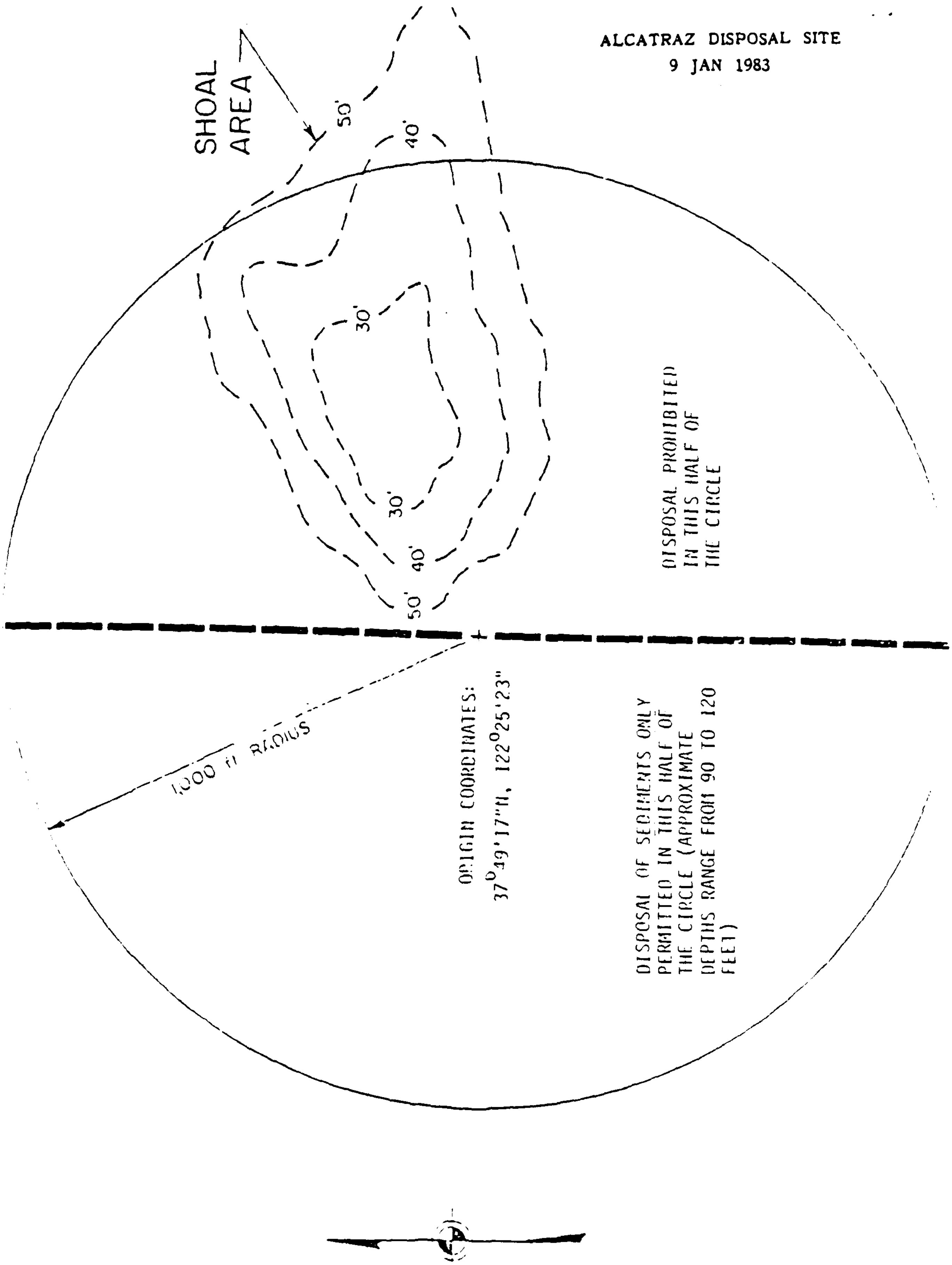


FIGURE 8

disposal site remains the appropriate site for disposal of dredged sediments. In order to create a more favorable condition for dissipation of the dredged material, disposal of the material in slurry form will be required for this project.

3.05 Detailed Plans

Plans consist of one or more management measures combined to address the established planning objectives. Measures which survived the screening process described in the previous section are combined into detailed plans. The following paragraphs present a description of detailed plans formulated for evaluation.

a. Plan 1: No Federal Project. Under "no action", existing channels and maneuvering areas would be maintained at present depths. The Southampton Channel is more or less self-flushing as a result of its orientation parallel to prevailing currents. Annual maintenance dredging of the Southampton Shoal Channel is estimated at 12,000 cy per year. The Maneuvering Area requires periodic maintenance by the Corps of Engineers to maintain its -35 ft. MLLW authorized depth. The 25-year maintenance record for the Maneuvering Area shows that an average of 70,000 cy of material are removed annually. However, the actual dredging of the Maneuvering Area is highly variable in terms of quantity and schedule. It is expected that there would be no changes in the maintenance dredging quantities of the existing project in the future.

b. Plan 2: Deepening Southampton Channel and Richmond Long Wharf Maneuvering Area - Dredged Material Disposal at Alcatraz. The Richmond Long Wharf Maneuvering Area and the Southampton Channel would be dredged to a depth of -45 feet MLLW. The width of the channel would remain at 600 feet and sideslopes would be 3 horizontal on 1 vertical. The dredging area is approximately 804 acres. Non-Federal interests would be responsible for dredging the berthing area adjacent to the Long Wharf. Disposal at the Alcatraz site in slurry form is assumed.

3.06 The final step of this Section is to select a preferred plan from the detailed plans just described. To complete this step four tests, (Functional Effectiveness, Public Acceptability, Economic Efficiency and Completeness) are once again applied. This second screening process does two things. First, it shows the disposition of the action alternative in light of the No Action Alternative and second, it details the action alternative in terms of its outputs. Table 4 below presents the comparison of alternatives. The environmental impacts of these alternatives are discussed in Environmental Impact Statement (Section 7).

TABLE 4

COMPARISON OF ALTERNATIVES
JOHN F. BALDWIN SHIP CHANNEL PHASE II

ALTERNATIVES DESCRIPTOR	DREDGING SOUTHAMPTON SHOAL CHANNEL (SSC)	NO ACTION
CHANNEL IMPROVEMENTS	Deepen to -45' MLLW Width 600'	NONE Depth -35' MLLW Width 600'
RICHMOND LONG-WHARF MANEUVER-ING AREA	Widen existing con-nection with channel and deepen to -45' MLLW	Maintain Existing at -35' MLLW
DISPOSAL AREA	Alcatraz (7 mi)	Alcatraz (Maintenance)
DREDGING METHOD	Hydraulic and Barge (Assumed)	Hopper Dredge (Maintenance)
NEW WORK DREDGING	8.8 M CY	NONE
CONSTRUCTION PERIOD	36 Mos	NONE
AVERAGE ANNUAL MAINTENANCE DREDGING	135,000 CY	82,000 CY
	FUNCTIONAL EFFECTIVENESS	
ACCESS TO RICHMOND LONGWHARF (RLW)	Full access to vessels with drafts up to 40'	Full access to vessels with drafts up to 30'
DISTANCE TO RLW FROM B&W BUOY "A"	4.1 N Mi	N/A
OBSTRUCTIONS TO NAVIGATION	NONE	NONE
NAVIGATION LIMITATIONS	NONE	NONE
VESSELS LIMITATIONS	40' Draft Vessels	30' Draft Vessels

TABLE 4 (Cont'd)

COMPARISON OF ALTERNATIVES
JOHN F. BALDWIN SHIP CHANNEL PHASE II

ALTERNATIVES DESCRIPTOR	DREDGING SOUTHAMPTON SHOAL CHANNEL (SSC)	NO ACTION
	PUBLIC ACCEPTABILITY	
LOCAL SUPPORT	Strong Support Indicated in Richmond Harbor Report	N/A
USER PREFERENCE	Preferred by RLW Users and local Pilots Assns.	N/A
AGENCY CONCERNS	Resource Agencies: magnitude of disposal; suggest ebb tide disposal	NONE
COMPATIBILITY WITH INSTITUTIONAL ARRANGEMENTS AND REQUIREMENTS	Fully compatible	Fully compatible
	ECONOMIC EFFICIENCY	
FIRST COSTS	FED $41,200,000 NON-FED 1,300,000 TOTAL $42,500,000	NONE
IDC**	$ 2,050,000	
ANNUAL COSTS	CAP $ 1,815,000 (3 1/4%) O&M 250,000 * TOTAL $ 2,065,000	O&M
ANNUAL BENEFITS	$ 5,969,000	N/A
NET ANNUAL BENEFITS	$ 3,904,000	N/A
B/C	2.9/1	N/A

* Incremental maintenance costs due to project improvements.
** Interest During Construction.

TABLE 4 (Cont'd)

COMPARISON OF ALTERNATIVES
JOHN F. BALDWIN SHIP CHANNEL PHASE II

ALTERNATIVES DESCRIPTOR	DREDGING SOUTHAMPTON SHOAL CHANNEL (SSC)	NO ACTION
	COMPLETENESS	
CHANNEL DEPTH	Adequate in meeting planning objectives	Inadequate in meeting planning objectives
CHANNEL WIDTH	Adequate in meeting planning objectives	Same as SSC
ROUTE TO RLW	Adequate in meeting planning objectives	N/A
NAVIGATION EFFICIENCY	Adequate in meeting planning objectives	Inadequate in meeting planning objective

Based on the preceding screenings of alternatives a decision for dredging the Southampton Shoal Channel is made. The No-Action Plan was not selected because it would maintain existing inefficient navigation conditions and therefore does not address the prescribed planning objectives. Dredging Southampton Shoal Channel is selected as the preferred alternative based on the following desirable outputs:

1. Maximum operational efficiency (reduction in lightering and tidal delays) in transporting crude petroleum between Central San Francisco Bay and the Richmond Long Wharf by providing a deep-draft, direct access, channel.

2. Increase in navigation safety for transporting crude petroleum between Central San Francisco Bay and the Richmond Long Wharf by eliminating the need for navigation in an area of man-made and natural obstructions to navigation.

3. Compatibility with public concerns.

SECTION 4

BASIS OF DESIGN

The existing Southampton Shoal Channel is 600 feet in width with flared widening at either end and is maintained at -35 feet MLLW. The existing Richmond Long Wharf Maneuvering Area located adjacent to the Wharf is irregular in configuration, varying from 600 to 2800 feet in width, extends 8,400 feet, and is also maintained at a depth of -35 feet MLLW. The Southampton Channel provides access from San Francisco Bay to the southwesterly side of the maneuvering area. The project improvement would result in deepening the existing 6000-foot-wide Southampton Channel to -45 feet MLLW, widening the North end for better entry into the maneuvering area and lengthening of the flared southerly end at its intersection with the existing San Francisco Main Ship Channel. The project improvement would also result in deepening of the maneuvering area to -45 feet within its existing configuration. For plan and sections of the proposed channel improvement, see Appendix D, Sheets 1 through 4.

4.01 Interim Design Memo Changes

This Interim Design Memorandum contains changes of project considerations and costs contained in the draft report. These changes are discussed as follows:

a. Dredging Requirements. Subsequent to the preparation of the draft report an up-to-date hydrographic survey was conducted and new quantities for the project improvement were computed totaling 8,800,000 cy. This was an increase from the 7,900,000 cy used in the draft report. In the draft report it was assumed that there would be hard and sticky materials in the overdepth, thus the draft report provided for removal of only 75 percent of the overdepth quantity (District dredging experience had demonstrated that historically about 75 percent of overdepth material had actually been dredged). Later investigations have revealed that this material will be soft, loose and easily dredged; therefore, the estimate in the final Interim Design Memorandum includes removal of all overdepth material. Due to the findings of more favorable dredging materials, coupled with the use of a hydraulic dredge, it is now considered reasonable to assume that total overdepth will be dredged. Drawings 1-34-8 (Sheets 1 thru 4 of Appendix D) present plans of the project using the new hydrographic survey, with updated coverage of the project boundaries and details of the intersection of the Southampton Shoal Channel and the San Francisco Main Ship Channel.

b. Dredging Method. In the draft report dredging was assumed to be a clamshell operation extending over a 4-year construction period, with disposal at the Alcatraz deep water site. In order to create more favorable conditions for dissipation of materials at the Alcatraz site, use of the hydraulic plant has now been substituted for the purpose of generating a slurry mixture of the dredged material. The plant selected for the above purpose consisted of a 20-inch hydraulic dredge with 3,000 cy scows for transportation of materials

to the disposal site. Upon arrival at the Alcatraz site the scows are dumped irrespective of tide cycle. Using this plant the dredging of the 8,800,000 cys is estimated to be accomplished in a 3 year period. Other types of dredging plants capable of meeting disposal site requirements will be allowed to bid for this job.

c. Project Cost. In this report the total cost is $42,500,000 (April 1984 price level), a decrease from the total project cost $43,150,000 (November 1982 Price Level) contained in the draft report. Major explanations for these changes are as follows: (1) Increase in mobilization and demobilization cost of $70,000 resulted from the need to obtain use of the 20-inch hydraulic dredge - not locally available; (2) The unit costs for dredging 7,876,000 cy was reduced 45 cents per cy in changing from the initial clamshell operations to the hydraulic dredge method; resulting in the cost reduction of about $3,545,000; (3) An increase in dredging quantity of 889,000 cy (resulting from a new hydrographic survey) at a unit cost of $3.50, increased costs by $3,112,000; (4) Contingencies and engineering costs for the revised estimate were reduced by $40,000 and $100,000 respectively due to the reduced project construction cost, (5) Navigation aids costs were adjusted upward by $10,000 following coordination with the Coast Guard. (6) Reduction in Non-Federal dredging cost of $150,000 due to unit cost reduction.

4.02 Geotechnical Considerations

a. Geology. The Richmond Long Wharf Maneuvering Area is located in an natural depression or drainage area in the broad, low-lying bay plain bordering the northeastern shore of the San Francisco Bay. Elevations on the bay plain in the vicinity of the harbor area vary from sea level to about 20 feet above sea level then gradually rising to the base of the Berkeley Hills to the east. Two hills, about 200 and 300 feet in height, are located in the area to the west and north of the Santa Fe Harbor Channel. The project site is a deep cradle of bedrock filled with clayey and silty marsh deposits commonly called "Bay Mud". The Franciscan formation is the bedrock of the area and is the oldest geologic unit present. Franciscan rocks are well exposed in the ridge west of the project area and 2,000 feet northeast of the Inner Harbor Basin. The proposed project area consists of younger bay mud which is a soft, gray, silty clay with minor amounts of fine sand and shell bits. Because this mud tends to become firmer and contains less water with increasing depth, engineers have classified it into two portions: a soft unconsolidated upper layer, and the older firmer layer beneath. The thickness of the younger bay mud in the proposed project area ranges from 20 to 50 feet. Because of its chemical composition, this mud tends to be very soft and plastic when wet and becomes brittle and shrinks when dierd. Generally a fine sand strata, 10 to 50 feet thick, lies underneath portions of younger bay mud.

A concealed trace of the San Pablo Fault crosses beneath the project from the northwest to the southeast. The San Pablo Fault is considered inactive since there is no existing evidence nor historical report of surface rupturing in the overlaying alluvium near the project area. The Hayward Fault, about three miles east of the project area, is considered active along its trace south of the Richmond where exposures and surface expressions both indicate

movement during historic time. The Hayward Fault is not considered close enough to the project to constitute a hazard from ground; however, seismic activity on the Hayward Fault could produce strong ground shaking at the project area.

b. Soils. Early in 1982, borings were made in the Richmond Long Wharf Maneuvering Area. Additional borings for Southampton Shoal Channel were made during late December 1983 and early January 1984. Locations of the boring holes are shown on Drawing No. 1-34-8, Sheets 1 thru 4 and logs are shown on Drawing No. 1-5-10 (Sheets 1 thru 3 Appendix D). Visual classifications of the soil samples were made during the field exploration program (and material gradations were determined by lab tests). The Long Wharf Maneuvering Areas soils vary from clayey sand to sandy clay and sandy silt. Classification of soils from Southampton Shoal Channel vary from silty sand, or clayey sand; to silt, sandy silt, clayey silt, silty clay and clay. Consistency of sand located within the Southampton Channel limits ranges from very loose to loose; while in the Maneuvering area the sand ranges from loose to loose; while in the Maneuvering area the sand ranges from loose to dense (As defined by Architect-Engineer (A/E) contract field logs). Consistency of the clay and silt materials range from very soft to soft in the Southampton Channel; and from soft to hard in the Maneuvering Area (As shown by A/E field logs).

c. Side slopes of 3 on 1 have been selected for use on this project. Based on consistency of the soils this is considered a stable slope for short term static conditions. With long term and seismic conditions the material on 3 on 1 slope would tend to slough, assuming a flatter more stable slope. Stability of the slope for the Southampton Shoal Channel was analyzed using strength from laboratory tests of the soil samples. A cohesion "c" of 180 p.s.f. and an internal friction angle "O" of 0 was used for a check of the slope stability in cohesive material. A static safety factor of 1.5 was obtained for the 3 on 1 slope. The slope will be stable for minor seismic conditions with horizontal accelerations of 0.015g or less. The static safety factor will be 1.6 for the 3 on 1 slope in sand, and seismic stability will be essentially the same as for cohesive material, with very shallow sloughing associated with minor seismic conditions.

4.03 Design Considerations

The authorized project depth of -45 feet MLLW was selected to provide a 5-foot safe clearance for petroleum tanker traffic. The safe channel clearance consists of one foot for squat of drawdown of water surrounding the vessel, two feet of trim of the vessel for better handling characteristics, and two feet of clearance between the ship's keel and the channel bottom, totaling five feet. Tankers drawing a maximum draft of 45 feet (85,000 DWT tanker fully loaded or other larger taker light loaded) would have ingress or egress at this depth, given a five-foot tidal advantage. (The full tidal range between mean lower low water and mean higher high water is 5.8 feet at nearby Richmond Inner Harbor.)

Improvement of the Richmond Long Wharf Maneuvering Area and the Southampton Shoal Channel to the depth of 45 feet (MLLW) is compatible with the improved depth of the San Francisco Bar Entrance Channel. Previous

deepening (1974) and continued maintenance of the San Francisco Bar Entrance Channel to 55 feet MLLW under this same "San Francisco Bay to Stockton, California" Ship Channel project authorization, limits the size of tankers having access to the San Francisco Bay to those with a maximum draft of 50 feet (55-foot channel depth, plus five-foot tidal advantage, less ten-foot safe bottom clearance); or to larger tankers which are light loaded to an equivalent draft. With the channel improvement, ship lightering demands are minimized, with only those tankers loaded to drafts in excess of 45 feet requiring lightering under conditions of tidal advantage. Southampton Shoal Channel, 600 feet in width, presently provides safe one-way passage for tankers as large as 150,000 DWT with beam widths of about 150 feet. A two-way channel was excluded from consideration after discussion with the U.S. Coast Guard and San Francisco Bay Pilots. Agreement was reached that only one-way traffic movements would be made along the route for safe passage due to the increasing size of vessels, handling characteristics, weather conditions, current velocities and directions and visibility limitations. The maximum waiting time for a vessel due to a one-way channel would be about 120 minutes. With vessel calls projected at 3 per day to the year 2000, the probability of significant delays is small and ship traffic congestion would be minimal.

The proposed channel has been tested by the navigation simulator developed by the U.S. Army Corps of Engineers Waterways Experiment Station (WES) in Vicksburg, Mississippi. The simulation study provided an opportunity to test the new channel configuration in a safe, controlled environment prior to construction. The major objective of the simulation study was to establish empirical support for the design of the recommended improvement plan. Test results have affirmed suitability of the project configuration as contained in this report.

4.04 Basis for Federal Cost

a. Dredging. Dredging of these features assumed the use of a heavy duty hydraulic dredge with a 20-inch diameter discharge line for agitating the dredge material to obtain a slurry which will readily dissipate upon disposal. The analysis also incorporated a supporting plant for the dredge and 3,000 cy scows for transport of the dredged materials to the disposal site. The new project estimate is based on a 3-year construction period to dredge the estimated 8,800,000 cy of material located between the currently maintained depth of 35 feet MLLW and the authorized depth of -45 feet. The estimate consists of the required dredging plus the allowable 2 foot overdepth dredging. Plans and Specifications for this project, however, would allow for dredging and disposal by other methods (i.e., hopper, clamshell) on a competitive bid basis, if that method can meet the strict discharge requirements for disposal in deep water of the Alcatraz dredge disposal site and construction schedule limitations.

b. Dredge Material Disposal. Material to be dredged is nearly equally divided between the Richmond Long Wharf Maneuvering Area and the Southampton Shoal Channel; 4,914,000 cy and 3,851,000 cy, respectively. Material will be transportated to the existing Alcatraz deepwater disposal site in San Francisco Bay, a distance of seven miles from the project. Scows will be

unloaded irrespective of tidal cycle upon arrival at the disposal site. Consideration was also given to disposal on ebb tides only. With adjustment of hydraulic dredge plant requirements for the "ebb tide only" conditions of operation, the unit price of dredging increases approximately 0.25 cents per cubic yard (contingencies and overhead included), an increase in total project first cost of approximately $2,200,000.

c. Navigation Aids. Two buoys will be installed at the South end of Southampton Shoal Channel to identify the intersection of its Northern boundary with the San Francisco Main Ship Channel centerline. Two buoys near the Northern end of Southampton Shoal Channel will be moved to identify two angle points between Southampton Shoal Channel and the Maneuvering Area. These requirements have been coordinated with the Coast Guard and are currently being coordinated with the Bay Safety Committee of the Marine Exchange. The cost of adding and relocating channel buoys is estimated by the Coast Guard to be $50,000.

d. Price Level. Costs are developed on the basis of other Bay Area dredging projects at April 1984 price levels. First costs are shown on Table 5.

4.05 Basis For Non-Federal Costs

To accommodate traffic using the Federal improved project the Non-Federal estimate assumes that the Non-Federal interests will deepen the 125-foot-wide by 3,700-foot-long berthing strip to -50 feet MLLW which is consistent with the present practice of maintaining the berthing area 5 feet below the Federal channel depth. This dredging improvement would therefore require removal of 275,000 cy of material. The estimate consists of the required standard dredge quantity plus the allowable 2 foot overdepth quantity. For purposes of this estimate it is assumed that the Non-Federal dredging would be incorporated in the contract for the Federal dredging improvement, subject to reimbursement by local interests. Thus mobilization and demobilization is a relatively minor cost item simply involving assignment of a pro-rata share of the Federal mobilization and demobilization to the local sponsor. Material would be excavated, transported 7 miles to the disposal site near Alcatraz where it would be disposed of in the approved deep water site. Costs are developed on the basis of other Bay Area dredging projects at April 1984 price levels. First costs for Non-Federal work are shown on Table 6.

4.06 Total Project Cost

The total project cost of $42,500,000 is comprised of a total Federal cost of $41,200,000 plus a total Non-Federal cost of $1,300,000. The detailed estimates are shown on Tables No. 5 and No. 6 following.

TABLE 5

ESTIMATE OF FEATURE FEDERAL FIRST COST
APRIL 1984 PRICE LEVEL

Cost Acct No.	Description	Quantity	Unit	Unit Price	Total
09	Mobilization & Demobilization	1	Job	L.S.	$ 450,000
	Dredging				
	Richmond Long Wharf Maneuvering Area Dredge - 35 feet to -45 feet MLLW				
	Standard Dredging	3,853,000	C.Y.	3.50	13,485,000
	Overdepth (2.0')	1,014,000	C.Y.	3.50	3,714,000
	Southampton Shoal Channel Dredge -35 feet to -45 feet MLLW				
	Standard Dredge	2,837,000	C.Y.	3.50	9,930,000
	Overdepth (2.0')	1,014,000	C.Y.	3.50	3,549,000
	Subtotal				31,128,000
	Contingencies ± 20%				6,272,000
09	SUBTOTAL				$37,400,000
30	Engineering & Design (6%)				2,250,000
31	Supervision & Administration (4%)				1,500,000
					$41,150,000
09	Navigation Aids (USCG)				50,000
	TOTAL FEDERAL FIRST COST				$41,200,000

1/ Unit prices do not include inflation during construction.

TABLE 6

ESTIMATE OF FEATURE NON-FEDERAL COST
APRIL 1984 PRICE LEVEL

Cost Acct No.	Description	Quantity	Unit	Unit Price	Total
09	Mobilization & Demobilization	1	Job	L.S.	$ 20,000
	Dredging -50' MLLW	275,000	C.Y.	3.50	963,000
	Subtotal				983,000
	Contingencies ± 20%				197,000
09	SUBTOTAL				$1,180,000
30	Engineering & Design (6%)				73,000
31	Supervision & ADministration (4%)				47,000
	TOTAL FEATURE NON-FEDERAL COST				$1,300,000

1/ Quantity includes 2 feet of allowable overdepth.

4.07 Maintenance

a) Federal

Maintenance related to deepening the Long Wharf Maneuvering Area from -35 to -45 feet will require the dredging of an additional 45,000 cy of material annually, for a total of 115,000 cy per year. Additional maintenance for Southampton Shoal Channel due to deepening will be 8,000 cy annually for a total of 20,000 cy per year. These estimates are derived by use of the formula below which assumes the increased maintenance dredging quantities to be directly proportional to the ratio of the squares of the new and existing depths. Since the project does not include channel widening, the factors for channel bottom areas are not included.

$$\frac{(d2)^2}{(d1)^2} = \text{Increased dredging quantity}$$

where: Z = Average annual maintenance quantity (70,000 cy for Long Wharf and 12,000 cy for Southampton)

d2 = New water depth (-45')

d1 = Old water depth (-35')

Based on a 2 year dredging cycle for the Long Wharf and a 5 year cycle for Southampton, additional maintenance dredging costs due to channel deepening are $170,000 per year and $80,000 per year respectively. Disposal at Alcatraz was assumed; mobilization was prorated; November 1982 price levels were used. Total incremental maintenance is $250,000 annually.

b) Non-Federal It is expected that the local interests will continue to maintain the Long Wharf berthing area to a depth compatible with the Federal project. Deepening the berthing area is not expected to impact appreciably on non-federal maintenance costs.

4.08 Changes in Total Project Estimates

Changes of Total Project Costs are reflected in the following comparisons, with indicated date of price level of each.

1/Authorized Project (July 1963)	1/Authorized Project at Current Price Level (October 1982)	2/Project as Last Presented to Congress (October 1983	2/Project as Now Recommended (April 1984
$7,157,000	$19,830,000	$52,725,000	$42,500,000

1/ Includes the Richmond Longwharf Maneuvering Area and West Richmond Channel.

2/ Includes Southampton Shoal Channel and Richmond Longwharf Maneuvering Area.

SECTION 5

ASSURANCE OF LOCAL COOPERATION

5.00 Before the project modifications proposed herein are constructed, non-Federal interests are required to provide assurance of local cooperation. The Board of Supervisors of Contra Costa County, by Resolution No. 2156 adopted 6 August 1965, endorsed the entire San Francisco Bay to Stockton Navigation Channels Project and expressed the intention of providing the required assurances of local cooperation. Prior to advertising for construction bids, the project sponsor will enter into an agreement with the Government in compliance with Section 221 of the Flood Control Act 1970, Public Law 91-611. This agreement will cover items of local cooperation required to implement the Phase II segment of the John F. Baldwin Project.

5.01 Departures From General Provisions

Certain items of local cooperation apply to other segments of the authorized project but are not applicable to the proposed Phase II feature. There is only one departure from the general provisions of the Project Document. The authorizing document set forth both aquatic and land disposal as alternatives for this segment of the project. Land disposal was found to be infeasible due to land use changes since the Survey Report. Since aquatic disposal is the selected method there is no requirement for land sites, retention dikes, relocation assistance, or other facilities related to land disposal.

5.02 Requirements of Phase II

Local interest will in addition to the general requirements of law for this type of project, agree to:

a. Give assurances that lands, easements, and right-of-way will be provided for construction and maintenance;

b. Agree to hold and save the United States free from damages which may result form construction and subsequent maintenance of the project, except damages due to the fault or negligence of the United States or its contractors;

c. Assure the accomplishment without cost to the United States of such alteration as required in sewer, water supply, drainage, transportation facilities and other utility facilities; as well as their maintenance;

d. Prohibit erection of any structure within 125 feet of project channels and basins;

e. Provide and maintain when and as required without cost to the United States depths in berthing areas and local access channels serving the terminals commensurate with the depths in the related project areas;

5.03 A Draft 211 Agreement is found in Appendix G.

5.04 Cost Sharing

During the course of the study, cost sharing became an issue because of the single beneficiary question at the Richmond Long Wharf. The authorizing legislation (79 Stat. 1089 and 1091) did not require local cost sharing for the navigation improvements in the Long Wharf Area. Congress adopted the recommendation of the Chief of Engineers, which did not include non-Federal cost sharing.

The position that local interests are not required by the authorizing legislation to share in the cost of improving the Long Wharf Maneuvering Area was reconfirmed by the Office of the Chief of Engineers on 10 June 1977.

SECTION 6

CONCLUSIONS AND RECOMMENDATIONS

6.01 Conclusions. The District Commander concludes that providing deepwater access to the Richmond Long Wharf from Central San Francisco Bay is justified on the basis of tangible future monetary transportation savings in excess of feature costs. Further the District Commander concludes that an opportunity exists to eliminate known operational and safety disadvantages in providing this deepwater access through improving the Southampton Shoal Connecting Channel as opposed to improving the West Richmond Channel as authorized.

6.02 Recommendations. The District Commander recommends that this Interim Design Memorandum be approved as the basis for preparation of contract plans and specifications for improving the Southampton Shoal Connecting Channel and Richmond Long Wharf Maneuvering Area.

EDWARD M. LEE, JR.
COL, CE
Commanding

FINAL ENVIRONMENTAL IMPACT STATEMENT

JOHN F. BALDWIN SHIP CHANNEL
PHASE II
RICHMOND HARBOR APPROACH

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SECTION 7

FINAL ENVIRONMENTAL IMPACT STATEMENT

John F. Baldwin Ship Channel
Phase II
Richmond Harbor Approach

The responsible lead agency is the U.S. Army Engineer District, San Francisco
The responsible cooperating agency is the U.S. Fish and Wildlife Service, Sacramento

Abstract:

The U.S. Army Corps of Engineers was authorized by Congress (PL 89-298) to construct navigation improvements for crude petroleum import to San Francisco Bay Area refineries. The Corps of Engineers has found that the increased use of larger tankers has resulted in savings through reduction in transportation cost, but at the same time has rendered most in-bay ship channels serving Bay Area refineries inadequate. The channels are generally too shallow to accomodate fully loaded large tankers without tidal delays or lightering. Various solutions to these problems in Central San Francisco Bay were analyzed. Included in the detailed analysis was deep-draft access provided by the improvements to the existing Southampton Shoal Channel and Richmond Long Wharf Maneuvering Area. Evaluation of this route, and a no-action alternative was performed. The key environmental factors considered in determining the merits of the alternatives in this study were their impacts on (1) water quality, (2) benthos, (3) energy, (4) transportation efficiency and (5) navigational safety.

SEND YOUR COMMENTS TO THE DISTRICT ENGINEER BY 15 JUL 1984

If you would like further information on this statement, please contact

Mr. Rod Chisholm
U.S. Army Engineer District,
San Francisco
211 Main Street
San Francisco, CA 94105
Commercial Telephone: (415) 974-0446
FTS Telephone: 454-0446

NOTE: Information, displays, maps, etc. discussed in the Interim Design Memorandum are incorporated by reference in the EIS.

FINAL ENVIRONMENTAL IMPACT STATEMENT

SUMMARY

MAJOR CONCLUSIONS AND FINDINGS

The major conclusions and findings are stated in the following paragraphs:

A. NED Plan: The selected plan would deepen 1.1 miles of channel from 35 to 45 feet below MLLW datum, and would produce maximum net benefits over costs. Hence, this alternative satisfies the definition of an NED plan.

B. Selected Plan: The improvement of the Southampton Shoal Channel would consist of dredging 1.1 miles of existing channel and the existing Richmond Long Wharf Maneuvering Area from -35 feet (MLLW) to -45 feet (MLLW). An estimated 8,800,000 cubic yards of material would be dredged and disposed of in the approved Alcatraz Island Disposal Site. The estimated first cost of construction is $42,500,000. Annual costs are estimated at $2,065,000 including capital costs and operations and maintenance. The benefit-cost ratio of the project is calculated at 2.9/1.

C. Findings Regarding Section 404 of Clean Water Act:

1. No significant adaptions of the guidelines were made relative to this evaluation.

2. Of the three designated open water disposal sites in San Francisco Bay, the use of the Alcatraz Island site, SF-11, would result in the most amount of dredged material leaving the Bay system.

3. The planned disposal of dredged material at the Alcatraz site would not violate any applicable State water quality standards. Short term turbidity will occur during each discrete dump. Turbidity generated by the disposal activity will be temporary. The disposal operation will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

4. Use of the selected disposal site will not harm any endangered species or their critical habitat or violate protective measures of any marine sanctuary or wildlife refuge.

5. The proposed disposal of dredged material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife and special aquatic sites. The life stages of aquatic life and other wildlife will not be adver ely affected. Significant adverse effects on aquatic escosystem diversity, productivity and stability and recreational, aesthetic, and economic values will not occur.

6. Steps to minimize potential adverse impacts of the discharge on aquatic systems included extensive sediment quality testing and evaluation of disposal on ebb tide. The added cost of ebb disposal, however is

approximately $2.2 million for this project. The U.S. Fish and Wildlife Service was requested to provide additional information on the environmental benefits of ebb tide disposal. Their report is contained in Appendix C. The Corps has evaluated this report and has concluded that disposal of slurried material on all tides will reduced the impacts of the project at no additional costs.

7. On the basis of the guidelines the proposed disposal site for the discharge of dredged material is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the affected aquatic ecosystem.

D. Findings Regarding Protection of Wetlands, Executive Order 11990:

1. Dredging sites and the selected disposal site are not located in or near wetlands.

2. No harm to any wetland area as a result of plan implementation is expected to occur.

3. The proposed action complies with this executive order and satisfies the Chief of Engineers Wetlands Policy.

E. Findings Regarding Cultural Resources: Based on investigations to evaluate the potential for prehistoric and historic cultural resources, the following findings were made: Deepening of the channel would not impact recorded prehistoric or historic resources, and in all likelihood, would not result in discovery of presently unknown resources of these types.

F. Findings Regarding Floodplains Executive Order 11988:

1. The proposed action is not located in any base floodplain.

2. The proposed action does not have any impacts in any floodplain nor will it indirectly support floodplain development.

3. The proposed action is in compliance with this executive order.

G. Areas of Controversy: Ebb tide disposal of dredge material is recommended by the U.S. Fish and Wildlife Service and was evaluated by the Corps. Ebb tide disposal increases the cost of the project by approximately $2.2 million over the unrestricted disposal cost. In the Corps opinion the extra cost of ebb tide disposal is not justified. The Corps concludes that unrestricted disposal of slurried dredge material will reduce impacts at no additional cost.

H. Unresolved Issues: No unresolved issues.

7-1 RELATIONSHIP TO APPLICABLE ENVIRONMENTAL LAWS, POLICIES AND PLANS

The following paragraphs list the principal environmental laws, policies or plans of Federal, State or local governments applicable to the proposed navigation improvements. Any inconsistencies between the proposed action and the laws, policies and plans are discussed, and the extent to which the proposed action shall reconcile such inconsistencies is also described. See Table 1-EIS for summary of alternative plans compliance with laws, policies and plans.

1.01 Clean Air Act. The objective of the Clean Air Act (P.L. 91-604; 84 Stat. 1704, 42 U.S.C. 1857 et seq) is to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population. The Act requires Federal agencies to perform an Air Quality Analysis for projects located within Air Quality Maintenance Areas to determine the effect of the proposed action upon the local Air Quality Maintenance Plan. It has been determined that emissions will not be increased by implementation of the proposed navigation improvements based on no change in the amount of cargo estimated for handling with existing facilities and a reduction in lightering activities. The Corps will require that the dredging contractor secure all necessary permits from the Bay Area Air Quality Maintenance District before construction.

1.02 National Environmental Policy Act (NEPA). NEPA (P.L. 91-190; 83 Stat. 852, 42 U.S.C. 4321-4327) established a national environmental policy to be considered in all Federal actions. NEPA directs all Federal agencies to include in every recommendation, report, proposal for legislation or other major Federal actions significantly affecting the quality of the human environment, a detailed environmantal impact statement. This environmental impact statement fulfills the requirements of NEPA.

1.03 Clean Water Act, Section 404. The objective of the Clean Water Act (P.L. 95-217; 33 U.S.C. 1344) is to restore and maintain the chemical, physical and biological integrity of the Nation's waters. Section 404(b) of the Clean Water Act as amended in 1977, requires that the Corps evaluate the impacts of the discharge of dredging or fill material into waters of the United States in order to make specified determinations and findings. A State Water Quality Certificate must be obtained for the discharge unless an exception is approved by Congress. An evaluation as specified in Section 404(b) has been included in this report, (see Appendix B, Section 404(b) Evaluation, for detailed information). A State Certificate will be requested for the proposed action in compliance with the above requirements.

1.04 Fish and Wildlife Coordination Act (FWCA). The FWCA (P.L. 85-624, 72 Stat. 563, 16 U.S.C. 661 et seq) requires that an action agency consult with the Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS) and state fish and wildlife agencies to determine the effects a project may have on fish and wildlife resources. Federal agencies must make the reports and recommendations of the FWS, NMFS and State agency an integral part of the reports submitted to Congress for authorization of construction. The project plan shall include such justifiable means and measures for wildlife purposes as the reporting agency finds should be adopted to obtain maximum overall project benefits. A U.S. Fish and Wildlife Service Report was included in the 1965 authorizing document. Supplements to this report are included with this document, see Appendix C.

1.05 Endangered Species Act, Section 7. Section 7(a) of the Act, P.L. 93-205 (87 Stat. 884, 16 U.S.C. 1531 et seq), requires that Federal agencies insure that their actions do not jeopardize the continued existence of endangered or threatened species or destroy or adversely modify the critical habitat that supports such species. Review of the U.S. Fish and Wildlife Service Listing and the State of California endangered species publications in relation to the tentatively-selected plan indicates no effect upon rare or endangered species or critical habitats. The U.S. Fish and Wildlife Service has confirmed this finding by its letter of 2 April 1982, (see Appendix C).

1.06 Executive Order 11990, May 24, 1977, Protection of Wetlands. This order states that Federal agencies should avoid to the extent possible the long-and short-term adverse impacts associated with destruction or modification of wetlands. No wetlands will be impacted by any project alternative.

1.07 Chief of Engineers Wetland Policy. This policy declares wetlands to be vital areas constituting productive and valuable public resources. Alteration or destruction of wetlands is discouraged as contrary to the public interest. As indicated above, no wetlands will be impacted by the project.

1.08 Water Resources Development Act, Section 150, P.L. 94-587 (WRDA). This legislation furnishes the Chief of Engineers with authority to plan and establish wetland areas in connection with dredging required for water resources development projects. The establishment of wetlands as provided in this Act was not determined feasible. The conditions of potential fill areas in the vicinity of the project do not permit the establishment of wetland areas without changing existing mudflats or shallow water areas.

1.09 National Historic Preservation Act (NHPA). The NHPA P.L. 80-665 (80 Stat. 915, 16 U.S.C. 470) requires that Federal agencies take into account the effect of their undertakings upon National Register properties. The National Register listing of Historic Places has been consulted and no National Register property shall be impacted by the project (see Appendix E CULTURAL RESOURCES, for further discussion).

1.10 Executive Order 11593, May 1971, Preservation and Enhancement of Cultural Resources. This executive order directs Federal agencies to assume leadership in preserving and enhancing the Nation's cultural heritage. The State Historic Preservation Officer has been contacted and it has been detemined that no State Historic Landmarks or State Points of Interest are located in the project area.

1.11 Section 4, Estuaries-Inventory-Study, Public law 90-454 (82 Stat. 625). This Act directs all Federal agencies to give consideration to estuaries and their natural resources and their importance for commercial and industrial developments, and to include in all project plans and reports affecting such estuaries and resources submitted to Congress a discussion by the Secretary of the Interior of such estuaries and such resources and the effects of the project upon them and his recommendations thereon. This discussion is provided under Fish and Wildlife Coordination Report (see Appendix C).

1.12 Coastal Zone Management Act Section 307, P.L. 92-583. This act directs all Federal agencies engaged in programs affecting the coastal zones to cooperate and participate with state and local governments and regional agencies in implementing the purposes of this act. The approved coastal management program for the area affected by the proposed project is contained in San Francisco Bay Plan, and the McAteer-Petris Act. In accordance with 15 CFR Part 930, it has been determined that the proposed action is consistent to the maximum extent practicable with the approved coastal management program (See San Francisco Bay Plan).

1.13 San Francisco Bay Plan (Bay Conservation and Development Commission). The Bay Plan provides a comprehensive and enforceable basis for protecting the Bay as a natural resource benefiting both present and future generations, and developing the Bay and its shoreline to the highest potential with a minimum of Bay filling. The following Dredging Policies are stated:

a. Sedimentation resulting from dredging will be minimized by conducting disposal at a designated location where the maximum amount will be carried outside the Bay on ebb tide.

b. The dredging will not result in unnecessary filling solely to dispose of dredged sediment.

c. The disposal area should be selected or dredged with due consideration to being least harmful to the ecology of the Bay.

d. Any proposed channel improvements should be designed to prevent undermining of adjacent dikes and fills.

e. The proposed improvements will not damage underground aquifers.

This authorized channel deepening and disposal activity for the John F. Baldwin Ship Channel is considered compatible with the policies of dredging in the San Francisco Bay Plan since the disposal is planned for the EPA approved Alcatraz Disposal Site (SF - 11) and dredging will primarily be in existing navigation channels.

1.14 State Water Quality Control Policy for Enclosed Bays and Estuaries. Requirements of this policy applicable to dredging and disposal operations include: compliance of dredged material with Federal criteria for determining acceptability for disposal into bay waters and certification of compliance by the Regional Water Quality Control Board. Refer to paragraph C, Clean Water Act, Section 404.

1.15 State of California Wetland Policy. This policy recognizes the value of marshlands and other wetlands. No wetland areas will be impacted by any project alternative.

1.16 Richmond General Plan (Richmond Coastline Plan - South Richmond Shoreline.) This local plan provides guidance for the conservation and development of Richmond's shoreline and related land water areas and resolves conflicting desires for environmental protection and urban growth. The proposed navigation improvements are considered compatible with the policies of the General Plan, since no shoreline areas will be directly affected by the proposed improvements.

TABLE 1 -EIS

SUMMARY

RELATIONSHIP OF NAVIGATIONAL IMPROVEMENTS TO APPLICABLE ENVIRONMENTAL LAWS POLICIES AND PLANS

<u>Federal Policies</u>	
Clean Air Act	Full Compliance
NEPA	Full Compliance
Clean Water Act	Full Compliance
FWCA	Full Compliance
Endangered Species Act	Full Compliance
EO 11990	Not Applicable
OCE Wetlands	Not Applicable
WRDA	Not Applicable
NHPA	Full Compliance
EO 11593	Full Compliance
Estuary Protection Act	Full Compliance
CZMA	Full Compliance
<u>State and Local Policies</u>	
State Wetlands Policy	Not Applicable
BCDC S.F. Bay Plan	Full Compliance
SWRCB Bays and Estuaries	Full Compliance
<u>Local Land Use</u>	
Richmond General Plan	Full Compliance

7-2 NEED FOR AND OBJECTIVES OF ACTION

2.01 Study Authority. This report is prepared pursuant to the Congressional authorization for construction of the San Francisco Bay to Stockton Ship Channel California Project; authorized in Public Law 89-298, adopted 27 October 1965 by the 89th Congress, 1st session. Basic information supporting authorization of the project is set forth in House Document No. 208 of that session. The portion of the project under study by the San Francisco District, the John F. Baldwin Ship Channel, has five areas of improvement and is defined as follows in the authorizing document.

a. Deepen the channel across San Francisco Bar to 55 feet without widening. (Completed in 1974)

b. Deepen the existing channel in Central San Francisco Bay leading through the west navigation opening of the Richmond-San Rafael Bridge to 45-foot depth and 600-foot width and deepen the maneuvering area adjacent to the Richmond Long Wharf to-45 feet; (the work considered in this EIS).

c. Deepen the Pinole Shoal Channel in San Pablo Bay within its existing 600-foot width and the maneuvering area at Oleum to 45 feet;

d. Construct a new 45 foot deep channel in Carquinez Strait near Martinez.

e. Deepen the Suisun Bay Channel to 45 feet as far upstream as Point Edith and widening and deepening to comparable depths of maneuvering areas at refinery terminals.

2.02 Purpose. The purpose of this EIS is to evaluate the environmental impacts of the alternatives for channel improvement in the Central San Francisco Bay, west of Richmond, California. The scope of this EIS is limited to a review of plans to accommodate present and prospective crude petroleum shipping through the Richmond Long Wharf facilities.

2.03 Public Concerns. Refinery facilities located at Richmond rely on waterborne transportation to supply most of their crude petroleum stocks. The present channel dimension of -35 feet MLLW deep restricts the size of tankers that can safely use the channel to 30 foot draft vessels. Larger tankers can enter San Francisco Bay through the Golden Gate but must be lightered or wait for high tide to proceed up the channel to the refineries. The proposed channel improvements are intended to rectify this situation for ships traveling to Richmond Long Wharf and provide a long term solution to the navigation problems associated with the delivery of crude petroleum to this immediate area. Specifically, the needs are to significantly reduce transportation costs by reducing tidal delays and lightering and increase safety. This concern for the navigational safety, as well as efficiency, of deep-draft vessel traffic using the Central Bay ship channels are addressed in the following planning objectives.

2.04 Planning Objectives. As a result of the analysis of public concerns the following objectives were derived and employed in plan formulation:

1. Improve efficiency (time savings) of navigation use at Central Bay and Richmond Long Wharf for the period of 1985 to 2035.

2. Improve the safety margin for navigation of vessel traffic using the Central Bay channels and Richmond Long Wharf for the period 1985 to 2035.

7-3 ALTERNATIVES

This section discusses the feasibility of various development concepts and construction methods. Included are non-dredging projects; channel improvements; single-stage channel development; development as a whole; land disposal and ocean disposal; in-bay disposal; and hydraulic dredging, hopper dredging, and clamshell dredging.

3.01 Central Bay Terminals and Ocean Monobuoys.

(a) Analysis of the John F. Baldwin Ship Channel improvements, authorized by Congress in 1965, included the examination of alternative non-dredging projects. Central Bay terminal and ocean monobuoys were considered as alternatives to a channel improvement project. Various locations were explored as possible project locations for building a central bay terminal or an ocean monobuoy.1/ One site considered for the construction of a central terminal was Treasure Island in San Francisco Bay. An area off-shore of Pacifica was studied as possible site for an ocean monobuoy. The Central Bay Terminal alternative included docking piers, an underwater pipeline, pumps and overland pipelines for distribution to refineries. The ocean alternative incorporated the use of monobuoys, underwater discharge pipelines, on-shore tank farm storage facilities, pumps, and overland and submarine pipelines for distribution of crude petroleum to each benefiting oil refinery.

(b) Implementation of these alternatives would not cause large impacts associated with dredging and disposal which are major concerns of deep-draft navigation improvement alternatives. Potential impacts of the central terminal or monobuoy alternatives include some aquatic impacts and a large number of land based impacts. The magnitude of environmental impacts for these alternatives have not been fully identified. However, construction of tank farms and many miles of pipelines in and through scenic areas, underwater terrain, and through congested urban and industrial areas would have significant impacts.

(c) The central terminal and monobuoy alternatives were considered economically feasible. But under current guidelines, these alternatives did not qualify for Federal cost sharing. Due to the high project cost and lack of local support, the central terminal and monobuoy alternatives were eliminated from further study.

1/ West Coast Deepwater Port Study, North Pacific Division/South Pacific Division, Corps of Engineers, 1976.

3.02 Single-Stage Development. This alternative contemplates development of the John F. Baldwin Ship Channel (Authorized Plan) in a single phase of construction.

(a) The channel is a deep-draft navigation that would facilitate the delivery of crude petroleum to six existing San Francisco Bay Area refineries. It includes the deepening of existing channels between San Francisco Bay and Point Edith in Suisun Bay from -30 and -35 to -45 feet MLLW and the widening of channels and maneuvering areas, where required, to meet present and prospective navigation needs.

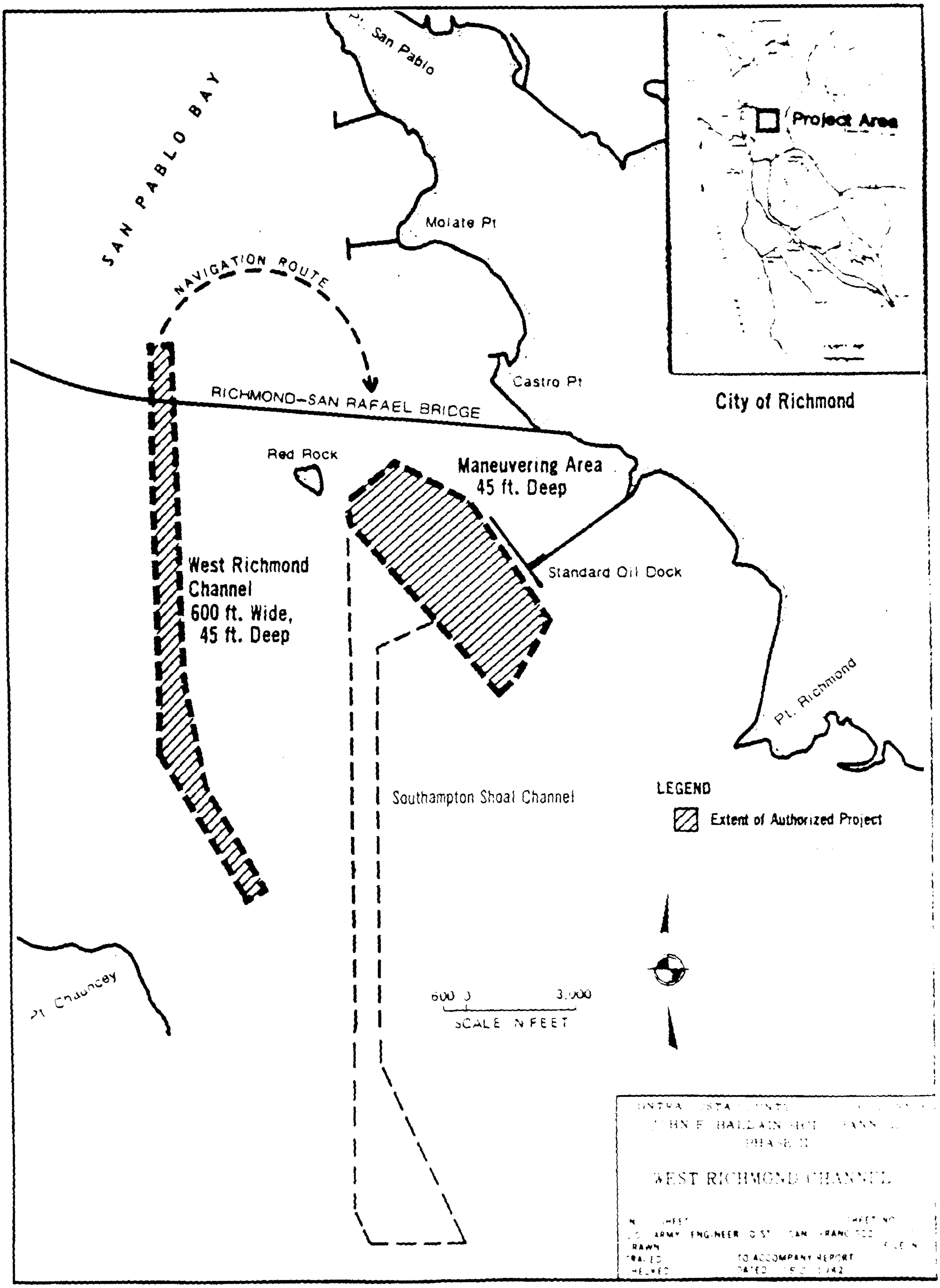
(b) Hydraulic model studies of the John F. Baldwin Ship Channel through Pinole Shoal without mitigation measures have shown increased salinity intrusion throughout Suisun Bay and the lower Delta, as a result of deepening. The consumptive uses of water (agricultural, municipal and industrial) would be affected by the increased salinity. In-stream uses would also be affected. The Delta serves as an important waterfowl producing area as well as a fish nursery and a major anadromous fish migrating passageway. The central and western Suisun Marsh also would be affected by salinity intrusion.

(c) To provide mitigative measures to offset the adverse impact of saline water in the Delta, a submerged salinity barrier was developed and model tested on the San Francisco Bay and Delta Hydraulic Model. The model tests of the fixed submerged barrier demonstrated the potential of such fixed structures to be means of maintaining control on most salinity intrusion. However further testing to refine the barrier design is needed. In addition the environmental effects of a submerged barrier, such as the effects on the null zone, movement of aquatic species, water surface elevations and sediment transport have yet to be adequately evaluated.

(d) The John F. Baldwin Project, developed as a whole, shows strong economic justification and would realize substantial transportation savings for the import of crude petroleum. However, based on the environmental uncertainties associated with the effects of dredging and disposal of nearly 22 million cubic yards dredged material and the problem of mitigating salinity intrusion, construction of the project is being conducted in phases.

3.03 Construction of the West Richmond Channel and Richmond Long Wharf Maneuvering Area.

This plan (Figure EIS-1) consists of dredging the West Richmond Channel and the Manuevering Area at the Richmond Long Wharf. The Channel would be deepened to -45 feet MLLW and 600 feet wide. The Maneuvering Area at Richmond Long Wharf would also be deepened to the 45' project depth over an area ranging from 600 to 2,800 feet in width and 8,400 feet in length. Completion of the dredging of this increment is the minimimum required to accrue transportation savings in the import of crude oil. Under this alternative, however, large vessels (100,000 DWT and larger) could not use the route because of bridge height limitations and smaller vessels (100,000 DWT and smaller) would not use the route during ebb tide due to saftey restrictions.



Pt. San Pablo
SAN PABLO BAY
Molate Pt
NAVIGATION ROUTE
Castro Pt
RICHMOND-SAN RAFAEL BRIDGE
Project Area
City of Richmond
Red Rock
Maneuvering Area
45 ft. Deep
Standard Oil Dock
West Richmond
Channel
600 ft. Wide,
45 ft. Deep
Pt. Richmond
Southampton Shoal Channel
LEGEND
Extent of Authorized Project
Pt. Chauncey
SCALE IN FEET
WEST RICHMOND CHANNEL
PHASE II
TO ACCOMPANY REPORT

FIGURE EIS-4

3.04 Dredge Disposal Alternatives.

(a) The disposal alternatives considered included land disposal, ocean disposal and in-bay water disposal at the historically-used Alcatraz disposal site.

(b) Land disposal of dredged material was included in the 1965 authorized project. The potential land disposal sites were re-evaluated on the basis of a four-mile pumping distance from the center of the project area. The land within an arc between Brooks Island and San Pablo Creek consists of wetlands and developed areas. Since it is economically preferable to locate the site near the dredge material source, the better sites fall into a category designated as wetlands or former wetlands (previously diked for various uses). Further complications in regard to land acquisition and site preparation costs as well as extensive mitigation requirements to offset the loss of wetlands and wildlife habitat makes this alternative impractical.

(c) 100-Fathom (Ocean). The site (SF 7) is located south of the Farallon Islands at Latitude 37°31'45"N and Longitude 122°59'00"W, 29.6 nautical miles from the Golden Gate. This site is located within the Farallon Islands Marine Sancturary. The depth is 100 fathoms, or 600 feet. This site had been generally considered when use of land or bay aquatic disposal sites were precluded. Determination to use this site is on a case-by-case basis in accordance with ocean dumping criteria, 40 CFR 227-228. Mixing characteristics are not as pronounced as other sites. Increased bottom turbidity and associated dissolved oxygen depression have the potential to smother benthic organisms at the site. The long distance from the project area would significantly increase the amount of fuel used, versus other disposanl methods.

(d) S.F. Channel Bar (Ocean). This site (SF 8) is parallel to and 6,000 feet south of the San Francisco Bar Channel five miles outside the Golden Gate. The site is used for maintenance disposal of sand. Placement of silty-clay at the site could result in longer periods of turbidity. Increased bottom turbidity and associated dissolved oxygen depression have the potential to smother benthic organisms at the site. However, organisms inhabiting the Bar are generally evolved for efficient locomotion and the ability to escape sustained burial. The expected dissimilarity between bottom sediments of this site and Bay sediments may result in a greater potential for adverse bottom impacts. The long distance to the channel bar site, although less than to the 100-fathom site, would also significantly increase the fuel consumption of the dredging project, versus use of disposal sites situated in closer proximity to the project site.

(e) Bay Disposal. There are presently three Bay aquatic disposal sites designated as suitable for dredged material disposal. Carquinez Strait (SF 9) is 0.8 nautical miles from Mare Island Straits entrance; San Pablo Bay (SF 10) is 2.6 nautical miles northeast of Point San Pedro; Alcatraz (SF 11) is about 0.3 nautical miles south of Alcatraz Island.

Due to the distance of SF 9 and 10 from project area, and the closer proximity of SF 11 to the Golden Gate Bridge, the Alcatraz Site has been selected for further evaluation. It is preferable environmentally. The site is characterized as a deep, high energy area, dynamic both physically and biologically. Material dispersion of unconsolidated sediments would occur within several minutes. Associated with sediment disturbance are certain temporary chemical changes in the water column. Since Bay mud is typically in an oxygen deficient state, oxygen is taken from the water column when the sediment is resuspended during disposal. This oxygen reduction in the water is localized at the disposal site and is short-lived. Toxic substances also associated with Bay sediments have not been found to be readily released from sediment attachment and into the water column. To insure environmentally safe disposal at this site, extensive water quality analyses are required.

Although Alcatraz disposal site is considered a high energy area characterized by high currents and scouring of the bottom, a dredge material mound has developed in the eastern half of the site. The area of the mound only occupies about 20 percent of the designated disposal area (bottom surface). This mound has apparently been formed by unauthorized disposal of concrete rubble in association with consolidated dredged sediments, which have not quickly eroded with the strong currents. The size of the mound has been monitored and it is being eroded. Corrective action will be taken before the end of the 1984 calendar year, independent of the proposed channel improvements to enhance the erosion process. The Alcatraz disposal site remains the appropriate site for disposal of dredged sediments. To facilitate dispersion of the dredged material, disposal in slurry form will be required.

[illegible] Alternative Dredging Methods.

(a) Hopper, hydraulic and clamshell are the alternative dredging methods considered along with the assumed clamshell and barge method. The type of equipment selected affects the characteristics of dredged material delivered to a disposal site and the duration, cost, and environmental impact of a dredging project. Conversely, dredging and disposal site characteristics limit equipment selection.

(b) Hopper Dredge. The hopper dredge is a self-propelled ocean-going vessel which removes material from the bottom of the bay or ocean by scraping and sucking through pipes known as drag pipes, which are trailed on the sides of the vessel. The dredged material is pumped into bins or hoppers in the vessel, from which it can be discharged by bottom dumping. Because of its size, the hopper dredge disturbs bottom sediment as it moves. However, this occurs with any deep-draft vessel. The cutting motion of the dredge also disturbs sediments. During loading, overflow periods return sediments to the water column. The dredging activity does not have a detectable long-term effect on water quality. The use of hopper dredges is dependent upon availability. The availability of privately-owned hopper dredges in the San Francisco Bay area is limited, but a hopper dredge may bid the job.

(c) Clamshell Dredge and Barge. The clamshell dredge removes sediment by a bucket which is dropped through the water and is then worked into the sediment. The bucket is raised and dumped into a barge, which when full

carries the sediment to the disposal site where it is discharged by bottom dumping or direct pumpout. Turbidity occurs as the clamshell bucket bites into the sediment and breaks free when it is hoisted. The bucket also loses sediment as it is lifted through the water and as it breaks free of the water surface and is swung to the barge. Consolidated material tends to remain in mass when disposed and would remain consolidated through the water column, even at high energy disposal sites. Material breakdown would depend upon plasticity of the sediments or liquid content and the current velocities generated by tidal influence, which would affect the rate in which the sediment is able to break apart and disperse. This dredging method was the assumed dredging method presented in the draft report. Clamshell dredging will be permitted only if disposal can be done in slurry form to facilitate dispersion of the dredged material.

(d) Hydraulic Dredge. Hydraulic pipeline dredges remove bottom sediment by sucking and pumping through a pipeline. This removal process yields a product different from the in-place sediment removal by a clamshell dredge, because in removing sediment the suction dredge requires water to form a slurry mixture. The hydraulic cutterhead suspends the least amount of sediment per dredge activity. Materials can be transported by barge or by pipeline as far as two or three miles with dredge pumps alone, and farther with remote booster units. The length of a fixed or temporary pipeline could be a hazard to navigation over long distances and will have significant adverse effects in heavily used designated aquatic Disposal Site in heavily used channels. Barge transport and dump at the Alcatraz disposal site in conjunction with this alternative was assumed to form the basis for estimating the cost for this project. The high rate of production was also a beneficial factor in assuming this method.

7-4 DESCRIPTION OF ALTERNATIVE PLANS

4.01 No Action.

(a) With this alternative deep-draft navigation through Central San Francisco Bay to Richmond Long Wharf would be restricted. The only fully loaded tankers, that could safely call at the Richmond Long Wharf without tidal delays would be those with drafts of 30 feet or less. Vessels with design drafts greater than 30 feet could still call at Richmond Long Wharf, but only under less than fully loaded conditions or after waiting for high tides. In addition, navigation difficulties at Richmond Long Wharf would continue due to the turning basin depth restrictions, even though Chevron has partially deepened its Long Wharf facility to better accommodate tankers used by that firm.

(b) To overcome the draft constraint of existing channels, deliveries would be met by increased lightering of large tankers in Central San Francisco Bay, south of the Bay Bridge, and increased use of existing channels by large tankers at high tide.

(c) The current magnitude of channel maintenance dredging would continue at approximately 82,000 cy per year. This activity results in short-term disturbances to the channel bottom. Disposal of dredged material

from maintenace dredging in the Central Bay, including sediments from Richmond Long Wharf, is also expected to continue. Presently, annual average disposal at the Alcatraz site totals about 5 million cubic yards, approximately 70,000 cubic yards is from Richmond Long Wharf (35'depth). Some increases in the total volume of maintenance dredged material may be anticipated due to the other deepening projects.

4.02 Plan 1: Improve Existing Southampton Shoal Channel and Richmond Long Wharf Maneuvering Area.

(a) This plan (Figure EIS-2) would provide direct access to Richmond Long Wharf via the existing connecting channel and an approach maneuvering area. The work would involve deepening the Southampton Shoal (Connecting) Channel from -35' to-45' MLLW. The width of the Channel would remain at 600 feet. The Richmond Long Wharf Maneuvering Area also would be deepened to -45 MLLW. The initial dredging required would remove approximately 8.8 million cubic yards of sediments, over a 36 month construction period. The Alcatraz disposal site with disposal of material in slurry form, would be used for this plan.

(b) Maintenance dredging in the Long Wharf Maneuvering Area would increase by an estimated 45,000 cubic yards per year. At -35' MLLW, the Southampton Shoal Channel has required infrequent, minimal maintenance dredging. It is estimated that maintenance of the -45' channel would increase by 8,000 cubic yards annually.

(c) The Federal Government would be responsible for supervision and administration of construction, maintenance of the channel to the selected dimensions, and provision and maintenance of necessary aids to navigation.

7-5 EXISTING ENVIRONMENTAL CONDITIONS

5.01 Location. The Southampton Shoal Connecting Channel is an in-bay shipping channel located west of Richmond Harbor. The Harbor is situated on the eastern side of San Francisco Bay, approximately 14 miles northeast of the Golden Gate Bridge. The main shipping lane extends from central San Francisco Bay through the west navigation opening of the Richmond - San Rafael Bridge and into the deep water of San Pablo Strait just upstream of the bridge. Parallel to the southern half of the main shipping lane is the Southampton Shoal Channel which provides a direct access to Richmond Harbor and the Long Wharf Maneuvering Area. The existing project maneuvering area near Richmond Long Wharf extends northward toward deep water near the east navigation opening of the bridge.

5.02 Economy. Richmond Harbor region is a Bay Area commercial port with petroleum and petroleum related products accounting for 75 percent of its total waterborne commerce. Tankers and containerships, as well as other craft, navigate through the in-bay shipping channels to reach Richmond. The nine-county Bay Area, is the second largest population center and marketing area on the Pacific Cost, and the seventh largest in the United States. The San Francisco Customs District ranks the third largest on the West Coast in international trade. The Port of Oakland handles the most tonnage of the

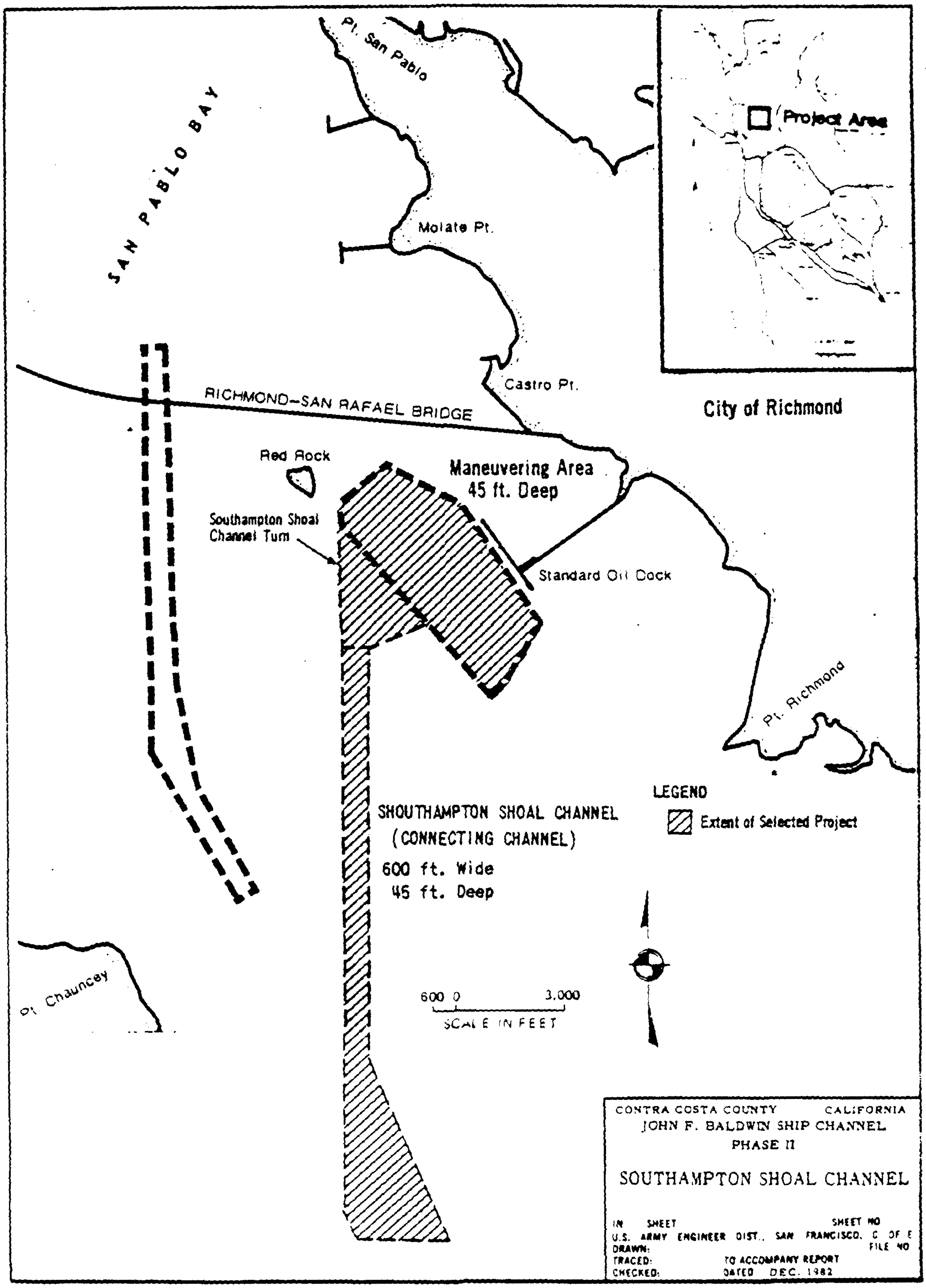

Pt. San Pablo
SAN PABLO BAY
Project Area
Molate Pt.
Castro Pt.
RICHMOND–SAN RAFAEL BRIDGE
City of Richmond
Red Rock
Maneuvering Area
45 ft. Deep
Southampton Shoal
Channel Turn
Standard Oil Dock
Pt. Richmond
LEGEND
Extent of Selected Project
SHOUTHAMPTON SHOAL CHANNEL
(CONNECTING CHANNEL)
600 ft. Wide
45 ft. Deep
Pt. Chauncey
600 0 3,000
SCALE IN FEET
CONTRA COSTA COUNTY CALIFORNIA
JOHN F. BALDWIN SHIP CHANNEL
PHASE II
SOUTHAMPTON SHOAL CHANNEL
IN SHEET SHEET NO
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN: FILE NO
TRACED: TO ACCOMPANY REPORT
CHECKED: DATED DEC. 1982

FIGURE EIS–2

fifteen areas of entry in the district, with Richmond handling the second most. Both of these ports are served by transcontinental railways and both are critical transfer points for waterborne commerce to land-based transportation modes. Most of the crude petroleum transported to Richmond is handled at Richmond Long Wharf which is operated by the Standard Oil Company. Exports from Richmond Harbor include machinery and transport equipment, food, and live animals. Water sports such as fishing and boating, are of minor importance in the port areas.

5.03 Ecology.

(a) The aquatic habitat includes the open water and bottom area below the low tide line. Living in the water are fish, invertebrates, and plankton. The mud and sand bottom support a variety of shellfish and worms. Together this biological community forms a food web that supports a variety of native and migratory fish and waterfowl as well as adult concentrations of harbor seals.

(b) All anadromous fish species associated with the rivers and streams of the Central Valley must swim through the project area or adjacent waters within Central San Francisco Bay during their migrations to and from the ocean. Chinook salmon, silver salmon and steelhead trout are the most important anadromous species with striped bass, American shad, and white sturgeon being other species for which project area waters afford a migration corridor. Shallow waters close to shore adjacent to the project area are believed to support rearing habitat for young anadromous species. This is supported by sampling performed by the U.S. Fish and Wildlife Service in 1974 near the City of Richmond. Young-of-the-year striped bass were caught in high numbers compared to other species captured during July through September. Pacific herring spawning is also known to occur in the intertidal zone and subtidal area (up to 15 feet depth) toward the landward side of the Long Wharf. Other species known to reside in the area include: northern anchovy, starry flounder, staghorn sculpin, shiner perch, surf smelt, jack smelt, three-spined stickleback, northern midshipman, Japanese goby, lingcod, sablefish, Pacific hake, cabezon, English sole, tiger shark, bat ray, spiny dogfish, Sacramento smelt, Pacific tomcod, white croaker, white surfperch, brown rockfish, speckled sanddab, and California tonguefish.

(c) Benthic and bottom-dwelling invertebrate species found in and adjacent to the project area include: a variety of arthropods (i.e., amphipods, isopods), jellyfish, horse mussel, basket cockle, Japanese cockle, softshelled clam, Franciscan bay shrimp, black-tailed bay shrimp, Oriental shrimp, hermit crab, slender crab and Dungeness crab. Crabs are found in the deeper waters off the shores of Point San Pablo and the coast of the San Pablo promontory. In the areas north of Point Isabel and around Point Richmond, beds of clams exist. All of the central and northern San Francisco Bay is an important recreation fishing area and has a high potential re-establishing a commercial shellfish fishery. This potential however, depends on the maintenance of spawning and nursery areas, and continuing improvement of the quality of the Bay water.

5.04 Earthquake Hazard. The Richmond Port area is subject to earthquakes to

the same degree as most other areas in California. The amount of damage that might occur is related in part to the geology of the site. See Section 4, Basis of Design for more information on earthquake effects.

5.05 Air Quality. The future air quality in the Richmond area was analyzed by the Richmond Public Works Department for the Environmental Impact Report, Richmond Redevelopment Plan. The Environmental Impact Report states:

> "Consultations were held with the personnel of the Bay Area Air Pollution Control District (BAAPCD). It was on their recommendation that, for the purpose of this analysis, the primary generator of pollutants is assumed to be the vehicular element and that any other generators would be considered of incidental importance."

In 1981 the San Francisco District performed an air quality analysis for the Richmond Harbor (including the Richmond Long Wharf) when considering deep-draft navigation improvements for that area. 2/ This analysis showed that air quality in Richmond generally is "good", and that while dredging would have a short-term impact on air quality conditions, no significant changes in future air quality conditions were identified with or without the project.

7-6 SIGNIFICANT RESOURCES

6.01 Study Area. The "study area" (Figure EIS-3) is defined as the Central San Francisco Bay from the Golden Gate Bridge in the West to the San Francisco-Oakland Bay Bridge in the South and the Richmond - San Rafael Bridge in the North. The project area is comprised of West Richmond Channel (main shipping lane), the Southampton Shoal Channel and Richmond Long Wharf Maneuvering Area. It also includes the waters of existing disposal site near Alcatraz Island. These are the areas directly impacted by implementation of any action alternative. Unless otherwise stated the impacts discussed apply to only the project area.

6.02 Environmental Relationship Matrix.

(a) The environmental relationship matrix that follows was developed by identifying the interaction between elements that exist within the study area. These relationships provide information for assessing the ecosystem's response to natural and man-made changes either directly or indirectly associated with the recommended plan and the alternatives. Definitions of the elements on the matrix are presented in Table EIS-2. The environmental relationship matrix itself is on Figure EIS-4.

(b) When anaylzing the environmental matrix that follows, it should be remembered that the elements listed in columns act upon those listed in rows and that the relationships indicated are the primary relationships that exist within the study area.

2/ Richmond Harbor Feasibility Report, Appendix K, Corps of Engineers, San Francisco District, 1981.

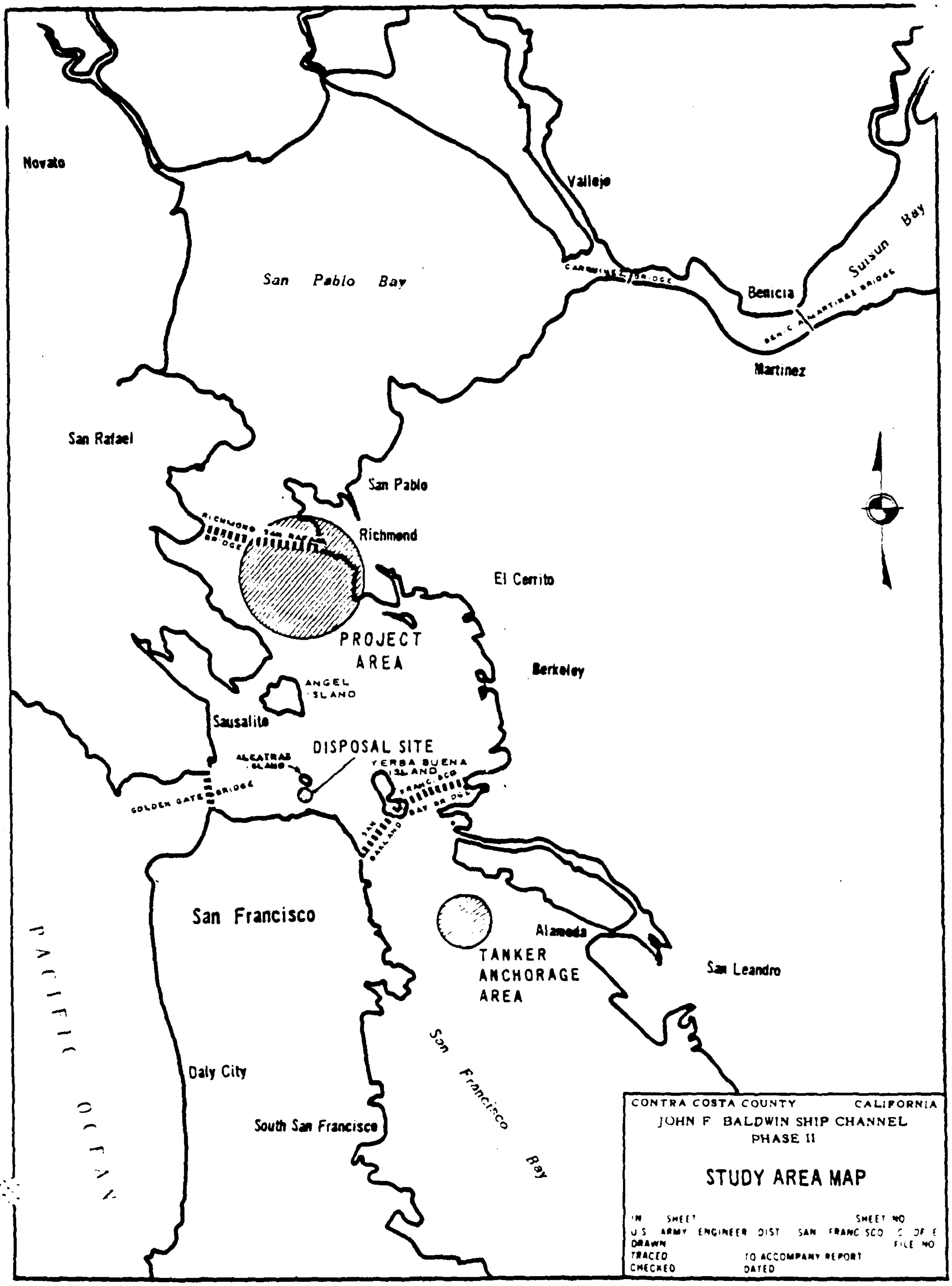

Novato
Vallejo
San Pablo Bay
CARQUINEZ BRIDGE
Suisun Bay
Benicia
BENICIA MARTINEZ BRIDGE
Martinez
San Rafael
San Pablo
RICHMOND SAN RAFAEL BRIDGE
Richmond
El Cerrito
PROJECT AREA
Berkeley
ANGEL ISLAND
Sausalito
DISPOSAL SITE
ALCATRAZ ISLAND
YERBA BUENA ISLAND
SAN FRANCISCO OAKLAND BAY BRIDGE
GOLDEN GATE BRIDGE
San Francisco
PACIFIC OCEAN
Alameda
TANKER ANCHORAGE AREA
San Leandro
San Francisco Bay
Daly City
South San Francisco
CONTRA COSTA COUNTY CALIFORNIA
JOHN F BALDWIN SHIP CHANNEL
PHASE II
STUDY AREA MAP
U.S. ARMY ENGINEER DIST SAN FRANCISCO
DRAWN
TRACED
CHECKED
TO ACCOMPANY REPORT
DATED
SHEET NO
FILE NO

FIGURE EIS – 3

TABLE EIS – 2

ELEMENTS IN THE ENVIRONMENTAL RELATIONSHIP MATRIX

Topography - The surface features of the study area.

Hydrography - Submerged topography.

Geologic Hazards - Hazards stemming from the geology, such as seismicity, liquefaction and tsunamis.

Water Quality - Quality of the water as it pertains to establised criteria.

Water Circulation - Movement and mixing of water.

Wave Action - The action of waves.

Erosion/Sedimentation - Removal and deposition of material by water.

Prime & Unquie Farmland - Prime farmlands are those whose values derives from their general advantage as cropland due to soil and water conditions. Unique farmlands are those whose value derives from their particular advantages for growing specialty crops. The designation of prime and unique farmland is made by U.S. Soil Conservation Service.

Air Quality - The condition of the air in and adjacent to, the study area in terms of its fitness to support life.

Noise - Sound without value.

Plankton - Free floating microscopic plant and animal life.

Benthos - bottom-dwelling flora and fauna and associated habitat.

Fish - Free swimming cold-blooded aquatic animals.

Mammals - Class of higher vertebrates including man, that bear live young, are warm blooded, nurse their young, and have hair over most of their bodies.

Rare/Endangered Species - Flora and fauna that has been designated as rare or endangered by State and Federal authorities.

Number of Inhabitants - Number of people inhabiting the study area.

Government and Civic Activities - Activities by government entities at various levels.

Land Use - Use of the land within the study area.

Desirable Community Growth - Community growth is defined as an increase in community population with a corresponding increase in community services and facilities. Community growth is desirable when it is consistent with stated community goals and values.

Aesthetic Quality - Aesthetics refer to the perception of natural and manmade beauty and the judgment involved in deciding what is beautiful.

Cultural Resources - Any building, site, district, structure, object, data or other material significant in history, architecture, science, archeology or culture.

Recreation & Leisure - Any form of play, amusement or relaxation engaged in during leisure time and facilities utilized in such activities.

Boating - Recreational use of boats.

Transportation/Traffic - Transportation is defined as the type, ease and degree of accessibility to desired locations by people from both local and regional points of origin. Traffic is defined as the movement of vehicles along roadways within the study area.

Public Facilities & Services - The availability and adequacy of facilities and services for the public.

Local Government Finance - Tax revenues, bonds, property values, public facilities and public services are some of the component parts of local government finance.

Business & Industrial Activity - Business and industrial activity comprises all producers of goods and services - they include all firms engaged in such production.

Natural Resources - Actual and potential forms of wealth existing in nature, including both living and non-living resources.

Manmade Resources - Structures, objects, or sites which have been planned, designed and constructed by man.

Employment/Labor Force - Employment consists of renumerative engagement in any occupation, business, trade or profession. The labor force consists of all persons 16 years of age and over.

Commercial Shipping - The business of shipping goods by private enterprise.

Energy - Power from the burning of fossil fuels, the operation of nuclear power plants, the tapping pf geothermal and hydroelectric power sources, and other sources such as the wind, the sun, tidal action, and hydrogren.

Desirable Regional Growth - The rates of economic and population growth of a region that are consistent with publicly defined objectives.

Community Cohesion - Community cohesion is the unifying force of a group due to one or more characteristics providing a commonality.

ENVIRONMENTAL RELATIONSHIP MATRIX

PASSIVE ELEMENTS \ ACTIVE ELEMENTS	PHYSICAL ENVIRONMENT	Topography	Hydrography	Geologic Hazards	Water Quality	Water Circulation	Wave Action	Erosion Sedimentation	Pedology	Air Quality	Noise	BIOTIC ENVIRONMENT	Plankton	Benthos	Fish	Mammals	R/E Species	SOCIO-ECONIMIC ENVIRONMENT	Number of Inhabitants	Government & Civic Activity	Land Use	Desireable Community Growth	Desireable Regional Growth	Community Cohesion	Aesthetic Quality	Cultural Resources	Recreation & Leisure	Boating	Transportation Traffic	Public Facilities	Local Government & Finance	Business Industrial Activity	Natural Resources	Man-Made Resources	Employment Labor Force	Commercial Shipping	Energy	Navigation Safety
PHYSICAL ENVIRONMENT																																						
Topography																																						
Hydrography				S				C																														
Geologic Hazards																																						
Water Quality				T		C		T												M								T								T		
Water Circulation			S	T			C																															
Wave Action			T	C																																S		
Erosion Sedimentation						S	S																															
Pedology																																						
Air Quality																				M								T	M							S		
Noise																				T								T	M							S		
BIOTIC ENVIRONMENT																																						
Plankton					C	M	T							S	S																							S
Benthos			S		C	M	T	T					C		S																							M
Fish			S		C	M							C	S		S																						S
Mammals										T	T				S																							
R/E Species					T					T	T				S					T	T						S											
SOCIO-ECONOMIC ENVIRONMENT																																						
Number of Inhabitants																					T	T	T	T	T		T											
Government & Civic Activity										T	T													S							T				S			
Land Use		T		S																M		T	T			T	T			T								
Desireable Community Growth																					M		M															
Desireable Regional Growth																			T		T	M													T			
Community Cohesion																																						
Aesthetic Quality																																						
Cultural Resources							T	T												T	T																	
Recreation & Leisure					T										M										M			M			T						S	
Boating							M																		M											T	S	
Transportation Traffic																																				M		
Public Facilities				S						T	T									T						S	S	M	S		C					T	S	
Local Government & Finance				T																T																T		
Business Industrial Activity																				T	T															M		
Natural Resources																				T																		
Man-Made Resources				T																																		
Employment Labor Force																				T		T	T									C				M	M	
Commercial Shipping			C																	T																	M	
Energy																				T							M	S	C							M		
Navigation Safety				C	T		S	T																														

L E G E N D (Primary Relationships)

C Critical

M Moderate

S Slight

T Theoretical but not identified in study area

FIGURE EIS - 4

(2) Benthos supports the larger aquatic life. Anadromous fish, those that travel between freshwater and salt water during part of their life cycle, may be found in waters of the study area. Striped bass, sturgeon and both Chinook and Coho salmon are of this group. The shallow Bay waters also support a variety of estuarine fish including perch, sharks and smelt. Many of these anadromous and estuarine species are important to commercial and recreational sport fishing. All of Central and Northern San Francisco Bay are considered important feeding areas for fishery resources. The vitality of this resource primarily depends on the maintenance of tidal flats and wetlands, and continuing improvement of the quality of Bay waters

(c) Energy.

(1) Improved efficiency in the transport of crude petroleum is a significant resource consideration. The rising cost of energy resources has been of critical concern for the past decade. Further increase in energy use and higher costs are likely in the future. More efficient fuel use by tankers is a significant contribution of the proposed channel improvements. The measure of efficiency are transportation cost savings resulting from the use of larger tankers. Since fuel is a major component of vessel operating costs, as overall costs decrease, fuel costs will also decrease.

(2) Table EIS-3 displays the impact of detailed plans on significant resources and plan economics. Details which describe the significant resources and the environmental effects may be found in Section 5.00. Environmental Effects.

4/ Dredge Disposal Study San Francisco Bay and Estuary, Corps of Engineers, San Francisco District, 1977.

Table EIS-3

COMPARATIVE IMPACTS OF ALTERNATIVE PLANS

Significant Resources

ALTERNATIVE PLANS	WATER QUALITY	BENTHOS	ENERGY	PLAN ECONOMICS	NAVIGATION
No Action, maintains -35' channel depth	O&M Dredging 82,000 cy Alcatraz disposal	Maintenance of existing resources values	Increasing lightering activities and tidal delays	N/A Annual Maintenance costs	Maintenance of existing acess and operational limitations
Deepen Southampton Shoal Channel -45' depth	New work dredging 8.8 million cy Alcatraz disposal Increase in annual O&M 53,000 cy	No change in existing resources values	Decreased lightering activities and tidal delays, short route	First Cost $42,500,000 B/C 2.9/1	Improved access and reduction of operational limitations

7-7 EVALUATION OF ENVIRONMENTAL EFFECTS

This sub-section evaluates the effects of each detailed plan on the previously described significant resources. An overview of the impacts is displayed in the comparative impact Table EIS-3. Figure EIS-5 is an impact tree which depicts the relationship of effects resulting from the navigation improvements and identifies the significant effects. The discussion below details the differences in degree of impact between the plans.

7.01 Water Quality.

(a) Type of Effect.

(1) The short-term, turbidity impacts resulting from sediment disturbance of dredging and aquatic disposal are unavoidable. The spatial and temporal extent of turbidity plumes resulting from disposal are dependent of the type of dredge used and on physical factors such as currents and winds. Duration of the turbidity resulting from a one time disposal event in the Bay is typically less than 15 minutes but may last up to an hour in low salinities. Since disposal would occur at the Alcatraz site, material dispersion and dilution would be expected to occur within several minutes. Disposal of dredged material by bottom-dump barge would be discrete and localized. Turbidity at the dredging site is continuous as long as the dredge is working. Turbidity resulting from dredging, however, is small scale compared to disposal turbidity.

(2) Associated with sediment disturbance are certain temporary chemical changes in the water column. Since Bay mud is typically in an oxygen deficient state, oxygen is taken from the water column when the sediment is resuspended during disposal. This oxygen reduction in the water is localized at the disposal site and is short-lived. Toxic substance also associated with Bay sediments have not been found to be readily released from sediment attachment and into the water column (see Appendix B, 404 Evaluation, Table 1). Chemical constituents that are released into the water column are not of such concentrations as to degrade water quality at the disposal site.

(b) Effects of Alternative Plans.

(1) No Action Plan. The Central Bay experiences swift currents which tend to maintain good water quality characteristics in this portion of the Bay. Salinity values are affected by outflow from the Delta and inflow from the ocean. Dissolved oxygen concentrations have improved in recent years due to increased treatment of municipal and industrial wastewater, discharged into the Bay. Long-term improvements in water and sediment quality are expected to occur as untreated wastewater discharges are eliminated, barring any major pollutant spillages. Federal, State and local regulatory policies governing water pollution control are expected to continue the implementation of water quality improvement goals. Under natural conditions, maximum turbidity in Central Bay occurs during the spring months when there is high outflow from the Delta. It has been estimated that about 10 million cubic yards of sediment are contributed to the Bay from the Sacramento and San Joaquin Rivers-Delta watershed complex annually. In addition an estimated

SIGNIFICANT IMPACTS OF ALTERNATIVES

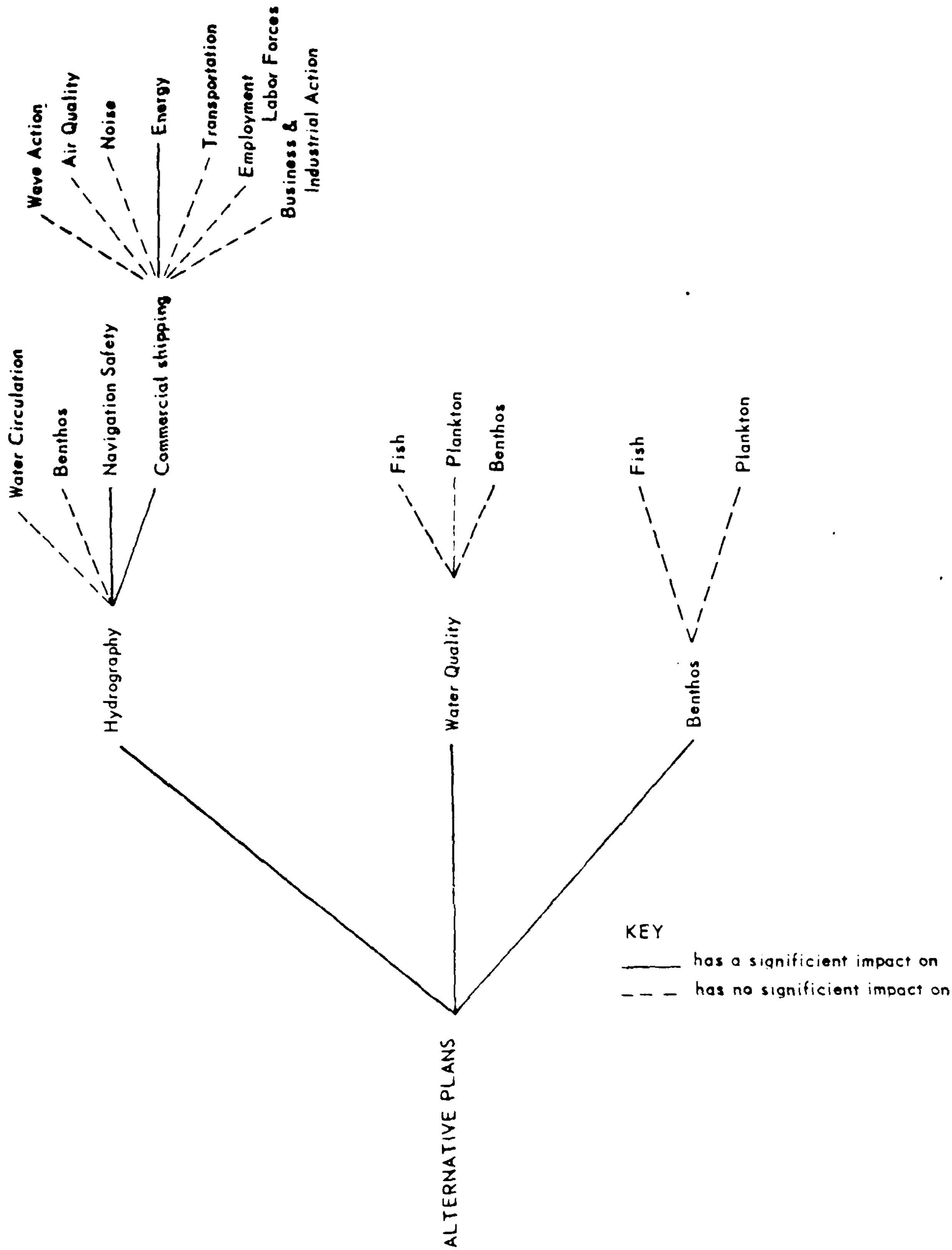


FIGURE EIS - 5

160 million cubic yards of Bay bottom sediments are resuspended annually in the Bay by wind and wave action as a part of the resuspension-recirculation-redeposition within the Bay. Dredging in the Bay disturbs approximately 10 million cubic yards of material in this natural system. Maintenance dredging of the existing project would continue under no action. Impacts of this dredging and disposal (87,000 CY) on water quality would not be significant.

(2) Plan 1: Southampton Shoal Channel and Richmond Long Wharf. The dredging and disposal operation associated with the improvement of the Southampton Shoal Channel and Richmond Longwharf Maneuvering Area could resuspend a maximum of 2 million cubic yards in the Bay annually. The impact of this material when added to the 160 million cubic yards of sediment already in the annual resuspension-recirculation-redeposition sediment budget of the Bay would not be significant. Salinity studies conducted for determining changes in the Suisun Bay and Delta areas have indicated that deepening channels in the central San Francisco Bay would have little or no effect on increasing salinity intrusion in these inland areas. The Central Bay experiences swift currents that aid exchanges between ocean inflow and Delta outflow. The deepening of the Southampton channel in this area would not exhibit different water quality characteristics than the without project condition.

7.02 Benthos.

(a) Type of Effect.

(1) During dredging, bottom organisms living in the interface between the water and the bottom substrate would be destroyed or at least displaced from the channel. At the disposal site, some benthos would be smothered by fall out dredged material. The extent of loss, however, is dependent upon conditions existing at the site and total amount of dredged material disposal. The loss of benthic populations would temporarily reduce the biological productivity of the channel areas and any role these areas play in the food web of the Bay. This adverse effect would be unavoidable. This does not mean, however, that disturbed channel areas will be permanently lacking in species or in numbers of individual species. Recolonization of the disturbed areas by bottom species is expected but the composition of the bottom community would be less diverse than that of the adjacent undisturbed areas.

(2) The Alcatraz disposal site might now support benthic animals deposited along with the dredge material deposited in recent years. If there is some temporary sediment mounding on the bottom due to disposal operations, those animals unable to exhume themselves would die. It is expected that actual benthic losses at the disposal site would be minimal. Except for those organisms directly hit by the dredged material, organisms in the water column (plankton and fish) would not be adversely affected.

(3) Prolonged increases in turbidity over ambient levels in the photic zone could, among other effects, decrease phytoplankton productivity, impair vision of predator species and impair filter feeding organisms. Any of

these effects resulting from the proposed dredging and disposal activities would be minimal due to depth of the dredging which is below the photic zone and the deep high energy characteristics of the disposal site which is not considered an area of high biological productivity.

(b) Effects of Alternative Plans.

(1) No Action. If the no action alternative is chosen, no dramatic change in existing benthic productivity of the channel areas would be detected. Maintenance dredging and disposal would continue to have an effect upon the dynamics of benthic populations. The Southampton Channel requires only infrequent maintenance dredging. And the Richmond Long Wharf Maneuvering Area would experience frequent maintenance dredging. Dredging disturbances would either limit the productivity of these organisms not tolerable to such conditions and compel adaptation of those organisms tolerant of such conditions. Some degradation of bottom communities resulting from distrubances from the propeller wash of smaller tankers or large tankers plowing the bottom would continue.

(2) Plan 1: Southampton Shoal Channel and Long Wharf Maneuvering Area. Due to the initial dredging the benthic community in the Southampton Channel would be temporarily depressed. However, considering the availability of the open-water habitat and undisturbed bottom habitat of the Bay in the study area, the benthic productivity of the Bay bottom probably would not be significantly affected. Although this plan would have minimal long-term impact upon the Bay ecosystem, deepening the channel would result in localized new disruption to the bottom. The Southampton Channel requires an average of ten feet of excavation to meet the project depth of -45 feet MLLW. Channel and maneuvering areas to be impacted by Southampton and Long Wharf Maneuvering Area total approximately 804 acres. Disposal operations at the Alcatraz disposal site would add to the cumulative disposal amounts already planned from Oakland Harbor, Richmond Harbor and the maintenance of other channels in San Francisco Bay.

7.03 Energy.

(a) Type of Effect. Energy savings to be derived from channel improvements consist of transportation savings of crude oil cargo passing from its source to the Richmond Long Wharf and travel time. Savings in transportation costs would accrue due to the reduction of lightering in transporting crude petroleum over the waterway, thereby reducing the unit cost of transport. The traveling time for each plan is discussed below. The amount of energy required in construction and maintenance with or without a project is not considered significant.

(b) Fff cts of Alternative Plans.

(1) No Action. This alternative would permit 30 foot draft vessels access to the Richmond Long Wharf Maneuvering Area without tidal delays or lightering. Since the petroleum shipping industry has increased tanker sizes, the result has been increased travel time due to lightering and tidal delays. At present (1979)[3] 46% of all tankers calling at Richmond [illegible] must lighter or wait for higher tide to enter the Harbor.

(2) Plan 1: Southampton Shoal Channel and Richmond Long Wharf Maneuvering Area. This plan would result in traveling time savings as well as increase transportation efficiency. The Southampton Channel provides direct access to the Long Wharf. If the improvements had been in place in 1979, 92% of all tankers calling at the Richmond Harbor in that year could have done so without lightering or waiting for tides. Thus this plan would significantly increase the number of tankers that could call at Richmond Harbor without lightering or tidal delays.

7.04 Other Considerations.

Effects of the plan implementation on other important factors, including those in the socio-economic environment and the physical environment, would also occur. These factors include navigational safety, crude petroleum shipping and hydrography, and have been identified on the impact tree (Figure EIS-5). The impacts on these factors in association with the alternative plans for navigation improvements, are discussed in the following sub-sections.

(a) Navigational Safety.

(1) Type of Effect. Navigational safety is a concern which has been directly identified as one of the planning objectives. Navigational safety has both first-order and second-order environmental implications. First - order environmental impacts involve the risk to human life and limb of passage through a channel. Second-order environmental impacts relate to the indirect impact or human well-being resulting from a navigation mishap. An example of the second order type of impact is the increase in environmental stress in the natural environment of an oil spill resulting from a collision or grounding of a tanker. The risk of collision involves essentially the entire Central Bay. Without channel improvements, the Central Bay is a "clearing - house" for lightering tanker traffic using the bay. Channel improvements would certainly reduce lightering traffic in the Central Bay. Additional safety benefits are contained in the selection of the safest route, as discussed below.

(2) Effects of No Action. Under the no-action condition, increased lightering operations and lightering traffic would increase the probability of navigation accident in the Central Bay by concentrating tanker traffic in the shipping hub of San Francisco Bay.

(3) Effects of Action Plan. The action plan provides sufficient widths to allow one-way passage of the largest ships presently calling at the Richmond Long Wharf. The Southampton Channel route is considered a safe route because it does not require any passage through any obstructions to navigation.

(b) Commercial Shipping.

(1) Type of Effect. Crude petroleum shipping is the direct beneficiary of the proposed improvements. By implementing navigation improvements, the efficiency and safety of shipping crude petroleum would be

3/ Waterborne Commerce of the United States, Part 4, Corps of Engineers, 1979.

increased as reflected in the planning objectives. Important savings due to the reduction in transportation costs would be realized by providing less dependence on the use of lightering vessels. The economic benefit to be gained would be the reduction in shipping costs for all crude petroleum imports moved through the waterway.

(2) Effects of No Action Plan. Without provisions for navigation improvements, continuation of tidal delays and increased lightering activities would take place.

(3) Effect of Action Plan. By implementing the Southampton Shoal alternative, the number of tankers calling at Richmond Harbor without lightering or tidal delays could be increased by 38% (1979 Data). The Southampton Shoal Channel would continue to be the primary route to the longwharf, but with an added margin of safety for ships 40 feet in draft and larger.

c. Hydrography.

(1) Type of Effect. Hydrography refers to the physical characteristics of the submerged bottom. Any proposed channel dredging would result in changes to the bottom. In the San Francisco Bay system, dredged shipping channels are out of equilibrium with the natural sedimentation processes. Sediment settling in deepened channels may be derived directly from sediment inflow to the Bay or it may be the result of the resuspension-recirculation-redeposition cycle. Shoaling rates in the dredged channels are not constant but vary from year-to-year, depending on the variable sediment inflow volume, wind-wave action and current velocities. During wet years with exceptionally high sediment inflow into the Bay, dredged channels normally experience higher sedimentation rates than in dry years. While current velocities in dredged channels work to remove sediment, they usually are not great enough to remove all sediment. For these reasons, sediments tend to accumulate in navigation channels until they are dredged.

(2) Effects of No Action Plan. The depth of the existing navigation channel is -35' MLLW. Annual maintenance dredging of the maneuvering area is expected to continue at 70,000 cy per year. The Southampton channel is more or less self-maintaining because of swift current velocities. Minor maintenance dredging (12,000 cy per year) is performed by the Corps on an as needed basis. Existing hydrographic conditions would not change.

(3) Effect of Action Plan. Based on the experience with the existing project it is expected that there would be minor increase in shoaling rate due to -45 foot depth in the channel areas. The Southampton Channel is in alignment with the San Pablo Strait and therefore subject to high current velocities with little or no cross-current. Maintenance dredging requirements for the project are expected to be 135,000 cy annually.

7-8 PUBLIC INVOLVEMENT

(a) Public meetings and conferences have been conducted throughout the studies of the John F. Baldwin Ship Channel and of navigational improvements

of Richmond Harbor to maintain coordination and obtain input from the general public, local sponsors, and Federal and non-Federal interests.

(b) In September 1977, the San Francisco District completed an environmental and economic status report on the authorized project which was made available to the public for review and comments. A public meeting was held on 16 October 1979 which presented the current John F. Baldwin Study results to the Contra Costa Board of Supervisors and the Contra Costa Development Association. Both indicated support for the completion of all environmental studies on the various channel projects and for early construction of those portions found to be environmentally sound. Another presentation to the Association's Navigation and Shoreline Development committee was held on 13 February 1980 to discuss the Corps' studies on an underwater sill in the Carquinez Straits to reduce salinity intrusion in connection with the Baldwin Ship Channel project. A Scoping Meeting with interested agencies was conducted by the District on 14 April 1980, to begin the preparation of this Environmental Impact Statement. A public meeting to discuss the project proposed in the Draft of this EIS and Draft Design Memorandum was held on 16 February 1984 at the Bay Model Sausalito, California. The transcript of the meeting is included as Appendix G.

(c) The U.S. Fish and Wildlife Service by a Planning Aid Letter (See Appendix C) recommended ebb tide disposal to minimize environmental impacts. The Fish and Wildlife Service provided a supplement to the Planning Aid Letter addressing the environmental benefits of ebb tide disposal. The Corps evaluated ebb tide disposal for this project, but so far has not been able to justify the additional $2.2 million in project costs required for ebb tide disposal procedures.

(d) Comments Requested. Comments on the Draft of this EIS were requested from the following Federal, State, Regional, County and City agencies as well as environmental groups and interested individuals:

Federal.

- U.S. Department of Agriculture
  - Soil Conservation Service
- U.S. Department of Commerce
  - San Francisco Field Office
  - National Oceanic Survey, NOAA
  - Economic Development Administration
  - Maritime Administration
- U.S. Department of the Interior
  - Bureau of Reclamation
  - Fish and Wildlife Service
  - Geological Survey
  - National Park Service
  - Advisory Council of Historic Preservation
  - Office of Environmental Project Review
  - Environmental Protection Agency
  - Region IX
- U.S. Department of Health, Education, and Welfare

U.S. Department of Housing and Urban Development
    Region IX
U.S. Department of the Navy
    12th Naval District
U.S. Department of Transportation
    Bureau of Public Roads
    12th Coast Guard District

State.

The Resources Agency
State Historic Preservation Office
State Water Resources Control Board, SF Bay Region
State Lands Commission

Regional.

Association of Bay Area Governments
Bay Area Air Pollution Control District
Metropolitan Transportation Commission
San Francisco Bay Conservation and Development Commission

County and City.

Contra Costa County
    Board of Supervisors
    Department of Public Works
    Planning Commission
City of Richmond
City of San Pablo
Port of Richmond
Port of Oakland
Port of San Francisco

Environmental Groups.

California Tomorrow
California Wildlife Federation
Contra Costa Shoreline Parks Committee
Ecology Center
Environmental Defense Fund
Friends of the Earth
Golden Gate Audubon Society
League of Women voters
Oceanic Society
People for Open Space
Save San Francisco Bay Association
Sierra Club
Society of California Archaeology
West Contra Costa Conservation League

7-9 COMMENTS AND RESPONSES

(a) Comments on the Draft of this EIS were received from the following:

U.S. Environmtal Protection Agency, Region IX
U.S. Department of Interior Office of the Secretary, Pacific Southwest Region
U.S. Department of Commerce, National Oceanic and Atmospheric Administration.
U.S. Department of Transportation, United States Coast Guard, Twelfth Coast Guard District.
California Regional Water Quality Control Board, San Franicsco Bay Region.
San Francisco Bay Cjonservation and Development Commission.
California Department of Fish and Game.
City of Richmond, Office of Port Director.
Chevron U.S.A., Inc.
Gary L. Gray (Oceanic Society).

b. As a result of the public review of the Draft Interim Design Memorandum No. 5 and Environmental Impact Statement, two substantive issues concerning the proposed project have arisen. Concern over the potential for mounding at the Alcatraz Disposal Site was expressed by the Department of Interior, Environmental Protection Agency, Department of Commerce and the Resources Agency of the State of California. These agencies also suggested that the assimilative capacity of the Bay system to handle the proposed disposal quantities has not been adequately demonstrated. Associated with both of these issues is the question of ebb tide disposal. All of the agencies mentioned above suggest ebb tide only disposal to reduce the impacts at the Alcatraz Disposal Site specifically and the Bay system in general.

In response to these concerns the Corps has revised the construction method, substituting a requirement for disposal of material in slurry form to facilitate material dispersion in lieu of clamshell and barge disposal assumed in the draft EIS. Under this requirement, any dredging method which provides for slurried disposal would be acceptable. The dredged material from the project consists of approximately 35% to 40% fine sands which may be deposited for a short time at the disposal site, but then moved onto the Presidio and Alcatraz Shoals which are primarily sand. The silts and clays of the dredged material will for the most part stay with the water column and be carried with the tidal flow, utimately becoming a part of resuspension - recirculation - redeposition sediment budget of the Bay. It is estimated that wind and wave action resuspends 160 million cubic yards of bay mud annually and that the suspended sediment load from the tributaries to the Bay adds 8 to 10 million cubic yards of material to the Bay annually. Dredging in the Bay redistributes approximately 10 million cubic yards of material in the Bay annually. Resuspended material from the proposed project would become part of this suspended sediment budget, increasing it by about 2 percent a year.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

Colonel Edward Lee, District Engineer
Department of the Army
San Francisco District, Corps of Engineers
ATTENTION: Mr. Rod Chisholm
211 Main Street
San Francisco, CA 94105

MAR 2 1 1984

Dear Colonel Lee:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the BALDWIN SHIP CHANNEL PHASE II; CENTRAL SAN FRANCISCO BAY SEGMENT; CONTRA COSTA AND SAN FRANCISCO COUNTIES, CALIFORNIA. We have the enclosed comments regarding this DEIS.

We have classified this DEIS as Category LO-2 (lack of objections - more information needed). The classification and date of EPA's comments will be published in the Federal Register in accordance with our public disclosure responsibilities under Section 309 of the Clean Air Act.

We appreciate the opportunity to review this DEIS. Please send three copies of the Final Environmental Impact Statement (FEIS) to this office at the same time it is officially filed with our Washington, D.C. office. If you have any questions, please contact Loretta Kahn Barsamian, Chief, EIS Review Section, at (415) 974-8188 or FTS 454-8188.

Sincerely yours,

Charles W. Murray, ~~Jr.~~
Assistant Regional Administrator
for Policy, Technical, and
Resources Management

Enclosure (2 pages)

cc: Morrie Taylor, U.S. Fish and Wildlife Service
Tom Yocum, National Marine Fisheries Service

404 Comments

This DEIS again raises the issue of the cumulative impacts resulting from the planned disposal of over 40 million cubic yards of dredged materials at the Alcatraz disposal site through fiscal year 1990.

Our comments on the earlier Oakland Harbor Improvements EIS were as follows:

> In light of the discovery that substantial mounding has already occurred at the Alcatraz site, many of the conclusions concerning water circulation patterns and redistribution of sediments may need revision. We recommend that additional studies be conducted to evaluate the ability of the Alcatraz site to assimilate and redistribute the projected large quantity of dredged material. In this regard the proposed limited use of the western half of the site should be specifically
> 1 addressed. In addition, we support the current study to identify a new disposal site in San Francisco Bay. Sites which carry the most material out of the bay system through the Golden Gate should be given priority.
>
> In terms of alternatives, EPA recommends that sandy material which does not require further chemical analyses be considered for beach replenishment. If this is not feasible, then limited use of the Channel Bar Ocean Dumping site should be considered for sandy material, if the dredged materials are demonstrated to be physically compatible with the substrate at the disposal site.
>
> (November 10, 1983 EPA comment letter on the DEIS for Oakland Inner Harbor Channel Deep-Draft Navigation Improvements)

In order for EPA to more fully understand the impacts of the planned dredging, we would like to schedule a meeting with members of your staff. We would like to discuss the various
2 dredge projects planned and any associated studies (current and planned). Also, since the U.S. Fish and Wildlife Service and the National Marine Fisheries Service have expressed similar concerns, we would like to have them attend as well. Please have your staff contact Ms. Loretta Kahn Barsamian at FTS 454-8188 so we can arrange a mutually acceptable time.

Our specific comments on this DEIS are noted below:

1. The DEIS described the problem with mounding of materials on the eastern half of the Alcatraz disposal
3 site. The FEIS should describe whether the mound on the eastern half affects the movement of materials that are being disposed on the western half.

2. The DEIS included a discussion on the cumulative effects on the aquatic ecosystem. There are several
4 other large dredging projects in San Francisco Bay that will involve disposal at the Alcatraz site within the next 4-5 years, and will result in an increase of 3.6 times above existing levels in FY86.

   The FEIS should provide enough detailed analytical discussion to substantiate the statement that "...The Bay system is capable of assimilating these quantities." (p. B-7)

3. In light of the projected increase of materials to be disposed at Alcatraz and the current mounding problem on the eastern half of the disposal site, the FEIS should give serious consideration to an ebb tide
5 disposal alternative. Consideration of the increased cost of ebb tide disposal should be tempered with consideration of the costs associated with any increase in the frequency or volume of dredging at other sites.

6 4. We recommend continued monitoring of the Alcatraz disposal site, to determine the status of the mound and the viability of continued use of the western half.

7 5. The detection limit of the method for PCB's analysis (p. B-5) should be specified.

RESPONSE TO ENVIRONMENTAL PROTECTION AGENCY

1. More information has been developed on the Alcatraz Disposal Site. Please refer to the response provided to the BCDC comment on the same subject.

Sands are contained in the dredge material from the JFB II project, but no area within the dredging area is made up of sand exclusively. Separating the sand from the fines prior to disposal would require development of new dredging techniques and increase the construction time.

2. An Inter-Agency meeting was held on 11 April 1984 to discuss the status of the Alcatraz Disposal Site and dredging and disposal impacts in general. Representatives from EPA, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game, BCDC, and the Corps attended.

3. Studies of currents with the mound in-place on the Bay model indicate that the mound increases the velocity of currents running through the western half of the disposal site. During the period between March 1983 to March 1984 an estimated 5.4 million cubic yards of dredged material was deposited in the western half of the disposal site. Hydro-surveys indicate that 1.1 million cubic yards of material accumulated at the site during this period. This build-up of sediments in the western half, however, is believed to be more the result of disposal in a smaller area than impeded currents.

4. The Corps judgment of the Bay system in assimilating the dredge material from all of the dredging projects listed is based on the comparison between the estimated 400 cubic yards per square mile per day of dredging related suspended sediments and the estimated 6,500 cubic yards per square mile per day of sediments suspended by wind and wave action. The increase over background levels in suspended sediment due to dredging is 5 %.

5. The California Department of Fish and Game commented on this same subject. Please refer to the response provided to the DFG.

An estimate of the savings in maintenance costs due to ebb tide disposal would, at the present time, have to be based on an assumed percentage of dredged material retained in the Bay and redeposited in the various navigation channels. An average dredging cost would have to be adopted because the unit price of dredging is variable due to differences in cost of dredging equipment and location of the channels to the disposal sites. The resulting assumed average savings due to ebb tide disposal would not be directly comparable to the known cost of ebb tide disposal for a specific project.

6. The Corps will continue to monitor Alcatraz Disposal Site. The construction contract for the proposed project will require the dredging contractor, as a minimum, to conduct or cause to be conducted, semi-monthly hydrographic surveys of the entire disposal site and furnish the resulting data to the government.

7. Comment noted. Text revised. PCB detection limits were:

0.0010 for samples A - DY of the West Richmond Channel
0.0500 for samples J - N4 of the Maneuvering Area
0.0005 for samples A' - G' of the Maneuvering Area
0.0500 for samples 1 - 5 of the Disposal Site Water

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
PACIFIC SOUTHWEST REGION
BOX 36098 • 450 GOLDEN GATE AVENUE
SAN FRANCISCO, CALIFORNIA 94102
(415) 556-8200

ER 84/49

MAR 16 1984

Colonel Edward M. Lee, Jr.
District Engineer, San Francisco District
U.S. Army Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Colonel Lee:

As requested by your letter of January 20, 1984, the Department of the Interior has reviewed the Draft Environmental Statement (DEIS) and Interim Design Memorandum No. 5, John F. Baldwin Ship Channel, Phase II, San Joaquin and Contra Costa Counties, California.

The following comments relate to concerns of the Fish and Wildlife Service (Service) and to the adequacy of the DEIS:

<u>General Comments</u>

We do not believe that the DEIS adequately addresses the potential impacts on fish and wildlife resources from disposal of dredge spoil at the Alcatraz site during the flood or incoming tide. No data is presented that supports that this is an environmentally acceptable alternative. The Service is concerned with the planned in-bay disposal of 7.9 million cubic yards of spoil, especially during the flood or incoming tide (Page 27, part 4.03b, last sentence). Even though the Alcatraz location is more environmentally desirable
1 for Bay disposal of spoil than the other proposed alternative in-bay site, dumping on the incoming tide will result in: (1) an adverse impact on fish and wildlife resources by lowering oxygen levels in the water column; (2) smother and/or displacing organisms; and (3) recycling spoils thereby contributing to water pollution throughout the Bay. If only fifty percent of the dumping occurred on the incoming tide, as much as four million cubic yards of spoil would be added to the bay, prolonging continued pollution and maintenance dredging problems. Concerns regarding in-bay spoiling have been expressed in the past and the Service will continue to recommend that spoiling be carried out on the ebb tide.

Specific Comments

Section 3, page 19, and 19(a) under part 3.03. The Alcatraz disposal area is
indicated as having an approximate depth ranging from 90 to 120 feet in the
western half of the site. Part of the eastern half has apparently accumulated
spoil in a mound ranging from -80 feet to -25 feet MLLW. The Service is con-
cerned with the apparent accumulation of spoil, as it appears that the material
2 has not been carried away as originally planned, and is gradually building up
throughout the entire disposal area. We mention this because other documents,
including C & GS map #5532, 34th Ed. dated Oct. 16, 1967, and the final Compos-
ite Environmental Statement for Maintenance Dredging, San Francisco Bay Region,
Vol. 1, 1975, indicate that the depths were 160 feet and about 130 feet, respec-
tively, in the past. The presence of the existing spoil mound and its potential
contribution to additional spoil accumulation in the area should be discussed in
the final EIS.

Page EIS-1(s) part C, item 5. This paragraph indicates that the disposal of
dredged spoils will not result in significant adverse effects on a number of
resources, including fish and wildlife. In addition, it also indicates that
life stages of aquatic life and other wildlife will not be adversely affected.
These statements may be more valid if all spoils were to be dumped during ebb
tides only. Dumping 7.9 million cubic yards during all tidal cycles could
result in more than fifty percent (3.9 million cubic yards) of the spoil be-
3 ing retained in the Bay for redeposition within the aquatic environment. The
settling out and resuspension of material over a four-year period could have
an adverse impact. Past studies on turbidity/sediment impacts on shellfish
and crustaceans have verified this potential impact. The statement should
be altered to reflect these facts.

Page EIS-4, paragraph 1.13, part a. This paragraph discusses the Bay Conser-
vation and Development Commission's policy on dredging. The policy indicates
that if no ocean site or adequate land disposal site is feasible, then dump-
ing in designated parts of the Bay, where the maximum possible amount will be
carried out the Golden Gate on the ebb tides, should be followed. It appears
4 that the policy is not being followed because dumping at the Alcatraz site
would occur on all tidal cycles, resulting in more than fifty percent of the
spoil being retained in the Bay. Page EIS-5, Table 1-EIS, under State and
Local Policies, BCDC S.F. Bay Plan indicating Full Compliance should be
changed to reflect this fact. There is an additional disposal site located
closer to the Golden Gate Bridge. That location or ebb tide disposal would
be more in compliance with the Policy.

Page EIS-9, part 3.04, item c. This paragraph indicates that due to the high
transportation costs and the acceptability of in-bay disposal, ocean disposal
was not considered further as an alternative (spoil site). It should be clari-
fied that the decision to not consider the ocean disposal site was based on
5 high transporation costs, not on the acceptability of in-bay disposal. The
Service has never considered in-bay disposal as adequate or completely accept-
able to fish and wildlife resources. An evaluation of probable fish and wild-
life impacts resulting from the proposed Alcatraz site was presented in a
November 17, 1982, Fish and Wildlife Coordination Act report (Appendix C of
DEIS).

If other alternatives are not considered further in the final EIS and if disposal at Alcatraz is inevitable, the Service concludes, with reservation, that since this is the least damaging of proposed in-bay sites, that disposal should be done only on the ebb flow of the tide. This is not to be construed as the Service's acceptability of in-bay disposal. It is recommended that the statement in the DEIS be changed to reflect this position.

Page EIS-17, part 7.02 BENTHOS. This discussion relates to the effects of
dredging and disposal on benthic organisms in the immediate dredging and
disposal area. It appears to minimize or de-emphasize the significance of
dredging an area of 804 acres and spoiling 7.9 million cubic yards in the
aquatic environment, of which approximately fifty percent is anticipated to
be recycled or retained in the Bay. It is stated that, "the loss of benthic
organisms would temporarily reduce the biological productivity of the channel
6 area." This is only partially correct. Repeated maintenance dredging related
to the project will continue to disrupt the area. This action, therefore, is
not a temporary condition. Another statement indicates that benthic losses
at the disposal site would be minimal. The DEIS fails to discuss the impact
on fish and wildlife resources of dumped spoil that is retained and carried
back into the Bay. Resuspension and redepositing of material to other in-bay
locations and its impact on aquatic organisms should be discussed in the final
EIS, especially in the areas outside of the navigation channels.

Page B-3, in Appendix B., item 2, Current Patterns and Circulation.

The final EIS should discuss the shoaling to 25 feet MLLW in the Alcatraz
disposal site in relationship to the statement in this paragraph, "...no
change in current patterns or velocities, etc., has occurred due to dredge
7 disposal." We mention this because (1) a recent nautical map #18650 of San
Francisco Bay, 37th Ed. Apr. 17, 1982 shows the deepest depth of the dispo-
sal area as 117 feet, and (2) our previous comments from page 19 and 19(a)
indicate concern with the mounding of spoil to -25 feet MLLW in 1983 from a
depth of 167 feet. It is difficult to believe that a 135-foot mound does
not influence some water circulation conditions in the area.

Page B-4, item 2. It is stated that, "No significant effects on chemical
and physical properties of the water column are expected from the proposed
disposal." We again question this since 53 percent of the 7.9 million cubic
yards will be returned to the Bay as suspended material and, eventually, will
be permanently retained in the Bay (page B-2, second from bottom paragraph).
8 Four million cubic yards of man-made spoil added to the natural inflow of
10 million cubic yards from the Central Valley, all contributing to turbidity
and shoaling, would appear to have a potential for significant impact on the
water column. Much of the 4 million cubic yards, after settling out, could
restrict shellfish bed expansion, and could require redredging of navigational
channels. We suggest the statement, "No significant effect ..." be changed.

Page B-7, item 3, first paragraph, second sentence. Previous comments apply
to this statement. The Service does not agree that dumping an initial 4 mil-
9 lion cubic yards of material into the Bay with resuspention, redistribution,
and settling to be acceptable to shellfish beds, fisheries, and wildlife
resources.

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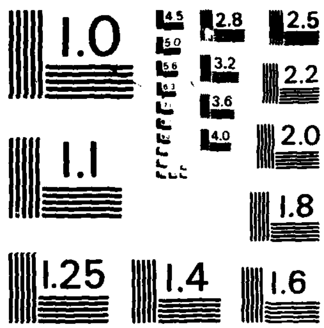

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10 Page B-7, last paragraph. Information in the DEIS does not support the statement that "the Bay system is capable of assimilating the (cumulative) quantities" of spoil disposal in an environmentally acceptable manner from the proposed dredging project and from other ongoing Federal and non-Federal discharges at the Alcatraz site. The statement "that the disposal activity does not add sediments to the system, but redistributes them and results in the movement of sediment to the ocean" is also not supported by the proposal of discharging spoil material on an incoming tide.

Summary Comments

11 As indicated in the foregoing comments, we believe there are several areas that should be more fully addressed in the final EIS. In particular, more emphasis should be placed on the identification of impacts to fish and wildlife resources that could result from spoil disposal at the Alcatraz site during an incoming tide.

We appreciate the opportunity to comment on this DEIS.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

cc: Director, OEPR (w/incoming copy)
Reg. Dir., FWS

RESPONSE TO UNITED STATES DEPARTMENT OF THE INTERIOR, OFFICE OF THE SECRETARY

1. In considering the feasibility of ebb tide disposal, the Corps requested the U.S. Fish and Wildlife Service to provide supplemental information of the environmental benefits of ebb tide disposal. The Service responded with a letter report dated 25 April 1984 (Inclosed Appendix C). In this letter the Service describes the environmental impacts of the disposal of dredged material during incoming tides, "Studies have shown that dredging and aquatic spoil disposal result in turbidity, sedimentation, burial of organisms, changes in substrate composition and bottom topography and releases of noxious materials and biostimulants. Each one of these conditions can cause stress and elimination of aquatic fauna and flora in the area and contribute to the instability of the environment."

The DEIS reports the extent turbidity impacts (DEIS Sec 7.01) sedimentation and changes in substrate (DEIS Sec 7.04c) burial of organisms (DEIS Sec. 7.01 a(2)) and releases of noxious material (Appendix B).

The Corps' opinion that turbidity impacts resulting from unrestricted disposal are not significant stems from research conducted and published by U.S. Army Engineer Waterways Experiment Station under the Dredge Material Research Program. For example, Technical Report DS-78-5 entitled Effects of Dredging and Disposal on Aquatic Organisms concludes, "Most organisms tested are very resistant to the effects of sediment suspensions in the water, and aside from natural systems requiring clear water such as coral reefs and some aquatic plant beds dredging-induced turbidity is not of major ecological concern. The San Francisco Bay is a shallow naturally turbid estuary. The stress impacts of dredging related turbidity on organisms living in high background levels of turbidity are difficult to assess.

Measurable changes in bottom topography and substrate composition and burial or organisms will occur only at the Alcatraz disposal site. This site represents an area approximately .02% of the bottom area of San Francisco Bay. The Alcatraz Disposal Site has been used for many years as a dredge material disposal area with the realization that the impacts of disposal operations at this site were accepted in lieu of the impacts of that could occur as a result of disposal operations in low energy, biologically more productive areas of the Bay.

The release of noxious materials and biostimulants from the disposal of project dredge material has been analyzed and reported as within the limits set for the Alcatraz disposal site (see 404 evaluation, Appendix B). The disposal site is the area where the highest concentration of released noxious material and biostimulants would occur. Concentration of these mateials outside of the disposal site diminish with mixing and settlement.

2. The San Francisco Bay Conservation and Development Commission shares this concern. Please see the response provided to BCDC on this same subject.

3. Without a citation of the past studies to which the Service is referring a specific response can not be made. However, studies conducted by the U.S. Army Engineer Waterways Experiment Station under the Dredge Material Research

Program provides additional information in support of the Corps' statements concerning the effects of dredging and disposal operations on shellfish and crustaceans. Technical Report D-78-21 cites 18 different studies concerning the effect of turbidity on estuarine bivalves and concludes that increased turbidity, while not affecting adults to any great extent, can have an effect on the percentage of normally developing eggs and larvae in laboratory tests.

4. The San Francisco Bay Conservation and Development Commission made a similiar comment. Please refer to the response provided to BCDC on this same subject.

5. The acceptability of in-bay disposal was judged on the basis of results of elutriate and bioaccumulation analyses performed using project dredge material as per the standard guidelines for in-bay disposal. High transportation cost played a significant role in identifying alternatives to the proposed action as required by the National Environmental Policy Act. Alcatraz disposal was selected on the basis that the disposal operation would meet the accepted regulatory criteria for in-bay disposal and because it was the least costly alternative in terms of transportation cost.

The Service's position on in-bay disposal is noted.

6. The Corps position that the dredging and disposal operation will not have a significant effect on benthic resources stems from the reasearch performed under the Dredged Material Research Program by the U.S. Army Engineer Waterways Experiment Station. Technical Report DS-78-5 (Synthesis of Research Results) entitled Effects of Dredging and Disposal on Aquatic Organisms concludes:

> "Dredging and disposal operations have immediate localized effects on the bottom life. The recovery of the affected sites occurs over periods of weeks, months, or years, depending on the type of environment and the biology of the animals and plants affected. The more naturally variable the environment, the less effect dredging and disposal will have, because animals and plants common to the unstable areas are adapted to stressful conditions and have life cycles which allow them to withstand the stresses imposed by dredging and disposal."

The project area consists of a man-made channel and maneuvering area, which are biologically unstable due to periodic maintenance and ship movements.

7. The Alcatraz site is still subject to high tidal current energies. A recent physical model study (COE, in preparation) of currents at the site with the mound in place predicted that net water movement at the site is to the west-southwest. A maximum velocity of 3.15 meters/sec was predicted to occur

on the spring tide with high delta outflows. Additionally, the testing found that maximum current velocities were greater at the site with the mound compared to the without mound condition.

8. Comment noted. The no significant effect determination applies the effect on the chemical and physical effect of the disposal at the Alcatraz Disposal Site. The disposal site is the area of most direct impact in chemical and physical changes. Chemical and physical change outside of the disposal site resulting from the disposal operation are believed to be less than in the disposal site.

9. Comment noted. Please see previous responses.

10. Comment similar to San Francisco Bay Conservation and Development Commission Comment No. 1. Please refer to response provided to BCDC at Response No. 1.

11. Comment noted. Please see response provided in answer to first USDI comment.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE ADMINISTRATOR

March 23, 1984

Lt. Colonel Edward M. Lee, Jr.
District Engineer
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, CA 94105

Dear Colonel Lee:

This is in reference to your draft interim design memorandum No. 5 and environmental impact statement for the John F. Baldwin Ship Channel, Phase II, Central San Francisco Bay segment (December 1983). Enclosed are comments from the National Oceanic and Atmospheric Administration.

We hope our comments will assist you. Thank you for giving us an opportunity to review the document. We would appreciate receiving four copies of the final environmental impact statement.

Sincerely,

David Cottingham for

Joyce M. Wood
Chief, Ecology and
Conservation Division

Enclosures (2)

DC:das

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Washington, D.C. 20230

N/MB21:VLS

March 23, 1984

TO: PP2 - Joyce M. Wood

FROM: N - Paul M. Wolff

SUBJECT: DEIS 8401.07 - John F. Baldwin Ship Channel Phase II Central San Francisco Bay Segment, San Francisco Bay to Stockton, California Project

The subject statement has been reviewed within the areas of the National Ocean Service's (NOS) responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

Our Office of Ocean and Coastal Resource Management has been in contact with Mr. Robert Batha of the Bay Conservation and Development Commission (BCDC) in California, who has already commented directly to the Corps on this DEIS. He stated that there are some specific concerns concerning the proposed dumpsite for the dredged materials and the potential impacts of dredging on existing aquifers. Although Mr. Batha did not review for consistency, he felt that they will be asked to make this certification for inclusion in the final document. NOS will defer to the State's comments.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, CA 90731

March 16, 1984 F/SWR33:TGY

Lt. Colonel Edward M. Lee, Jr.
District Engineer
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, CA 94105

Dear Colonel Lee:

The National Marine Fisheries Service has reviewed the Draft Interim Design Memorandum No. 5 and Environmental Impact Statement for the John F. Baldwin Ship Channel, Phase II, Central San Francisco Bay Segment (December 1983). In order to provide as timely a response to your request for comments as possible, we are submitting our comments (enclosed) to you directly, in parallel with their transmittal to the National Oceanic and Atmospheric Administration (NOAA) for incorporation in the NOAA response. These comments represent the view of the NMFS. The formal, consolidated views of the NOAA should reach you shortly.

Sincerely yours,

for E. C. Fullerton
Regional Director

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, CA 90731

March 16, 1984 F/SWR33:TGY

Lt Colonel Edward M. Lee, Jr.
District Engineer
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, CA 94105

Dear Colonel Lee:

The National Marine Fisheries Service (NMFS) has reviewed the Draft Interim Design Memorandum No. 5 and Environmental Impact Statement (EIS) for the John F. Baldwin Ship Channel, Phase II, Central San Francisco Bay Segment. These comments are provided under authority of the Fish and Wildlife Coordination Act and the National Environmental Policy Act.

1 Our primary concern over this project is the potential adverse impacts of the disposal of nearly 8 million cubic yards of material at the Alcatraz disposal site. We do not believe that these impacts will be negligible as the draft EIS suggests or that material will not accumulate significantly at the site or other sites in the Bay. We believe that the DEIS should discuss the impacts of dredge disposal more thoroughly prior to preparation and release of a final EIS for this project.

For example, the draft EIS states that disposal of dredged material will not be allowed in the eastern half of the Alcatraz disposal site because recent hydrographic studies indicate a 55-foot mound of dredged material there. The base of the mound is at -80 feet MLLW. We are concerned that this is strong evidence that dredged material disposed at Alcatraz is not leaving the Bay, nor, apparently, the disposal site. As a worst case, disposal of 7,900,000 cubic yards of dredged material on one-half of the Alcatraz site could create (assuming no movement or sloughing), a mound over 140 feet in height in water that is less than 120 feet deep.

We are not suggesting that dredged material from the Central San Francisco Bay Segment of the Baldwin Ship Channel will create a new island off Alcatraz. However, we do believe 1) that significant quantities of dredged material have remained at this site from previous and ongoing projects and 2) that the depths and bottom contours at this site are significantly different from previous Corps reports. Corps studies as recently as 1975 reported the depth at the Alcatraz site as -160 feet; the draft EIS found maximum depths of -120 feet and minimum depths of -25 feet.

2 The draft EIS should be revised to better discuss the fate of dredged material that is disposed in San Francisco Bay. Previous studies referred to in the draft EIS showed that although little material disposed of at Alcatraz would remain at that site, that over half of the material would remain within the Bay. Recent hydrographic data would seem to refute the claim that the material disperses away from the site quickly. In addition, if 53% of the material would remain in and be redeposited in Central and South San Francisco Bay (as Corps studies conclude), we

question whether this material will exacerbate dredging problems of others needing new or maintenance dredging.

The natural inflow of sediment to the Bay has been estimated at between 6 and 8 million cubic yards annually. The proposed project could increase this amount of
3 suspended material by 17% to 35% depending upon how much material is suspended and retained within the Bay. This problem should be evaluated and included in benefit-cost analyses.

The National Marine Fisheries Service supports the proposal of the U.S. Fish and Wildlife Service that material from this dredging project be disposed of on ebb tides only. Further, we understand that the Corps has been evaluating alternate sites for dredge disposal; such sites would, themselves require approval and would
4 be subject to an EIS. We believe that evaluation of alternate sites should be included in the EIS for this project. The Alcatraz site is rapidly becoming unacceptable; only half of it can be used for this project, and, combined with disposal from other projects, it may be totally unusable in the near future.

Accordingly, whereas the NMFS does not object to the project, per se, the disposal of the nearly 8 million cubic yards of material at Alcatraz needs to be evaluated more thoroughly. We believe that disposal of the material during ebb tide and during periods of high Delta outflow would reduce but probably not eliminate these problems; such disposal methods should be evaluated in the draft EIS as well as impacts from alternate (new) disposal sites west of Alcatraz.

If you wish to contact us further on this matter, please direct comments to Thomas G. Yocom at: National Marine Fisheries Service, 3150 Paradise Drive, Tiburon, CA 94920-1299; telephone (415) 556-0565.

Sincerely yours,

for E. C. Fullerton
Regional Director

cc: CDFG, D. Lollock
FWS, J. McKevitt
EPA, L. Wong

RESPONSE TO DEPARTMENT OF COMMERCE

1. Similar comments concerning the Alcatraz Disposal Site were voiced by the U.S. Department of Interior, and San Francisco Bay Conservaton and Development Commission. Please refer to the response provided to USDI and BCDC on the subject of Alcatraz.

2. Comment noted. Additional text has added to Section 7-9 of the EIS which discusses expected fate of the dredge material. The U.S. Department of the Interior and the San Francisco Bay Conservation and Development Commission and the California Department of Fish and Game voiced similar comments. Please refer to the responses provided to those agencies for additional discussions on the same subject.

3. Wind and wave action resupends an estimated 160 million cubic yards of Bay sediments annually. This amount added to the sediment contributed by natural inflow brings the total annual amount of natural resupended sediment in the bay to nearly 170 million cubic yards. The amount of resupended material contributed to these background levels (assuming 3 million yards of dredged material is resupended) represents a 2% increase in the total.

In order for the "problem" of resupended material to be accounted for in benefit-cost analysis, a dollar value must be developed on either the benefit or cost side of the ratio. The U.S. Fish and Wildlife Service has suggested a savings benefit in reduced maintenance dredging requirements resulting from ebb time disposal. The Corps' position on this suggestion is that the savings could only be applied on project specific basis and that before and project specific savings could be developed, a realistic study of the amount of material resupended by project disposal operations and redeposited in the project area would have to be conducted. Based on the Corps experience with the Carquinez tracer study performed as a part of the Dredge Disposal Study (COE 1975), the cost of a similar study conducted for Alcatraz Disposal would cost several million of dollars and still not provide conclusive results on which to base a maintenance dredging savings.

4. The Corps position on ebb tide disposal is expressed in a response to the California Department of Fish and Game and BCDC. Please refer to response 3 provide to the DFG and response 1 to BCDC.

The Corps' positon on the Alcatraz Disposal Site is that it is and will continue to be the best available site for the proposed project's disposal operations (see response to BCDC on the same subject). The Corps is presently investigating alternative disposal sites for the formal designation of an ocean disposal site. An EIS detailing the selected site and alternative sites will be prepared by the Corps for the Environmental Protection Agency in its designation process. At present, envirormental baseline studies of alternative in-bay and ocean sites ae being conducted by the Corps for this EIS.

U.S. Department of Transportation
United States Coast Guard

Commander
Twelfth Coast Guard District

Government Island
Alameda, CA 94501
Staff Symbol: (dpl)
Phone: FTS 536 31'

16452
23 Mar 1984

Colonel Edward M. Lee Jr.
District Engineer
San Francisco District
U.S. Army Corps of Engineers
211 Main Street
San Francisco, CA 94105

Dear Colonel Lee:

The Twelfth Coast Guard District has reviewed the Draft Environm tal Impact Statement (DEIS) for the John F. Baldwin Ship Channel, Phase II, Central n Francisco Bay, California, as well as the Draft Interim Design Memorandum No. ' This letter provides the Twelfth Coast Guard District response to the DEIS and su e nts Mr. Wheeler's letter dated 16 January 1984 on this subject.

The plan for Phase II, as described in the DEIS, provides for the 45 foot Baldwin Channel to follow the alignment of the existing Southampton Shoal Channel which leads to the east navigation span of the Richmond-San Rafael Bridge which has only 135 feet of vertical clearance. The West Richmond Channel leads to the main (west) span of the bridge with a 185 foot vertical clearance but offers nominal 35 foot depths. Larger ships (greater than 135 foot height and deeper than 35 foot draft) would find both routes impassable despite the announced intent of the Baldwin Channel project to enable them to reach terminals in San Pablo Bay and Carquinez Strait. This anomaly (i.e. deep draft channel leading to lower, secondary bridge span; shallower channel leading to higher, main span) might change vessel traffic patterns.

I recommend that the final EIS include data concerning the drafts and heights of typical ships that could be expected to use the Baldwin Channel. The EIS should also analyze the effects on maritime traffic patterns of the proposed deepening of Southampton Shoal Channel. If a significant number of vessels require a vertical clearance of greater than 135 feet, routing the Baldwin Channel under the west span of the Richmond-San Rafael Bridge would make greater economic sense.

Sincerely,

W. F. Merlin

W. F. MERLIN
Captain, U. S. Coast Guard
Chief of Staff
Twelfth Coast Guard District

RESPONSE TO U.S. COAST GUARD, CHIEF OF STAFF

1. The USCG concern regarding the John F. Baldwin Ship Channel appears to be related to the Phase III portions of the project, rather than Phase II. The Phase II portion provides terminal access without passage through the bridge. Use of the West Richmond Channel would require tankers destined for the Long Wharf to pass under the bridge twice. The use of Southampton Shoal Channel eliminates entirely the need to pass under the Richmond-San Rafael Bridge for the Phase II portion which was an important safety consideration in selecting this route. The current plan for Phase III is to utilize the West Richmond channel with the 185 foot vertical clearance under the bridge. Consideration of ship heights as well as drafts will be an important aspect in the Phase III evaluation project.

Studies developed for the Phase II project indicate that the primary delivery ships to use the channel will be 140,000 and 150,000 DWT Tankers with expected design drafts of 54 feet and 55 feet. The height of the mast above the waterline is typically 138 feet loaded and 149 feet ballasted.

U.S. Department of Transportation
United States Coast Guard

Commander (oan)
Twelfth Coast Guard District

Building 51-3
Government Island
Alameda, CA 94501
(415) 437-3506

5410/16517.20
16 January 1984

From: Commander, Twelfth Coast Guard District
To: District Engineer, U. S. Army Corps of Engineers San Francisco District

Subj: John F. Baldwin Ship Channel DEIS; Comments on

Ref: (a) Your ltr of 20 Jan 84 w/DEIS

1. Reference (a) has been reviewed and the following comments are submitted:

1 a. Request this office be advised of any effect the project will have on federal aids to navigation (required relocation, etc.).

2 b. Request this office be advised two weeks prior to the start of the dredging project and continually advised of dredging operations as the contractor's equipment affects navigation.

W. C. WHEELER
Chief, Aids to Navigation Branch (Acting)
By direction of the District Commander

Copy to: Commander, Coast Guard Group San Francisco
Commanding Officer, Coast Guard Marine Safety Office
Commanding Officer, Coast Guard Vessel Traffic Service
CCGDTWELVE (m)

RESPONSE TO U.S. COAST GUARD, AIDS TO NAVIGATION BRANCH

1. Reference a meeting on 5 April 1984 between the Coast Guard and the Corps of Engineers. It was determined that two new aids to navigation are required at the intersection of the Southampton Shoal Channel with the Main Shipping Lane and that two existing aids to navigation in the maneuvering area would be relocated.

2. Comment noted.

Resources Building
1416 Ninth Street
95814

(916) 445-5656

rtment of Conservation
rtment of Fish and Game
rtment of Forestry
rtment of Boating and Waterways
rtment of Parks and Recreation
rtment of Water Resources

GEORGE DEUKMEJIAN
GOVERNOR OF
CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

Air Resources Board
California Coastal Commiss
California Conservation C
Colorado River Board
Energy Resources Conser
and Development Comm
Regional Water Quality
Control Boards
San Francisco Bay Cons
and Development Comm
Solid Waste Management Board
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control
Board

Colonel Edward M. Lee, Jr.
Army Corps of Engineers
211 Main Street
San Francisco, CA 94105

March 15, 1984

Dear Colonel Lee:

The State has reviewed the draft IDM-5 and EIS, John Baldwin Ship Channel, Phase II, submitted through the Office of Planning and Research.

Review was coordinated with the San Francisco Bay and State Lands Commissions, Air Resources and State Water Resources Control Boards, and Departments of Conservation, Fish and Game, Water Resources, and Health Services.

Three agencies have responded directly to you on this matter:

--San Francisco Bay Regional Water Quality Control Board (letter of February 15, 1984)

--San Francisco Bay Commission (letter of March 7, 1984)

--Department of Fish and Game (letter of March 13, 1984)

We would appreciate your consideration of these letters in the preparation of the final document.

Sincerely.

Gordon F. Snow
Gordon F. Snow, Ph.D
Assistant Secretary for Resources

cc: Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814

(SCH 84011010)

TATE OF CALIFORNIA GEORGE DEUKMEJIAN, Governo

ALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
i FRANCISCO BAY REGION
JACKSON STREET, ROOM 6040
AKLAND 94607

Phone: Area Code 415
464-1255

February 15, 1984
File No. 2118.04(MJA)omt

Colornel Edward M. Lee, Jr.
District Engineer
San Francisco District,
Corps of Engineers
211 Main Street
San Francisco, Ca. 94105

Dear Colornel Lee:

Subject: Draft EIS For The John F. Baldwin Ship Channel, Phase II, Central San Francisco Bay Segment, SCH# 84011010.

We have reviewed the subject draft EIS and have the following comments:

ENVIRONMENTAL CONSIDERATIONS, WATER QUALITY, PAGE 11

We feel that the bioaccumulation tests are incomplete since the uptake of coliform organisms by shellfish was not investigated.

1 When our respective staff met some time ago to discuss our concerns regarding sediment resuspension and the possible impacts on shellfish and shellfish growing waters of resuspended coliform organisms, we emphasized the need to include coliform uptake as part of the bioaccumulation studies. We strongly recommend that coliform uptake by shellfish be evaluated before the subject project begins.

If you have any questions regarding this matter, please call Michael Ammann at (415) 464-1357.

Sincerely,

Fred James for

Richard H. Whitsel
Chief of Planning

cc: Price Walker, State Clearinghouse

RESPONSE TO CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

1. We have consulted with our hydrologic and dredging technical staff at the San Francisco District and the Waterways Experiment Station in Vicksburg and also with Bob Smith of Brown and Caldwell, Inc. in Pleasant Hill, who conducted hydrologic modelling for the Point Richmond Study discussed in San Francisco Bay Shellfish: An Assessment of the Potential for Commercial and Recreational Harvesting, 1977. We propose the following in order to insure protection of the Cypress Point Shellfish Beds, which are the closest, most valuable potential recreational shellfish bed to the proposed dredging for phase II of the John F. Baldwin Ship Channel project:

a. Total and fecal coliform concentrations will be determined for surface sediment samples in the area to be dredged. (We believe this information is available from the literature. If not, we will take fresh samples that will then be sent to a local contracting lab for analysis.)

b. The amount of material to be resuspended by our dredging operation will be estimated. Based on the assumption that soil coliform bacteria do not desorb from the soil particles, the associated coliform concentration will then be calculated.

c. Using the same sediment distribution model and current direction and magnitude as was used in the Point Richmond Study for the worst case (i.e. slack tide when counter-clockwise currents could transport soil and coliforms to the Cypress Point beds), the concentration of coliform organisms that could possibly reach the shellfish beds will be calculated. Appropriate die-off and dilution assumptions will be made.

d. Cummulative concentrations of coliforms at the bed will be estimated (either by adding the concentration of coliform due to our dredging to the known background concentration of coliforms now existing at the beds or to already predicted concentrations of coliforms due to other sources such as runoff, wastewater outfalls, boating emissions, etc.). This estimation will be performed for the summer months when recreational shellfishing could occur.

e. The cummulative concentrations will be compared to the Public Health Department's limitations on total and fecal coliform concentrations in shellfishing growing waters. If these limitations are exceeded, operational procedures may be stipulated in order to keep the coliform concentration in the beds from actually exceeding the limits (possibilities include dredging in certain areas only during winter months or restricting dredging during the period of slack tide for certain areas to be dredged).

2. Our staff will stay in close contact with the California Regional Water Quality Control Board's staff during the execution of these tasks in order to insure that their concerns are adequately addressed. Results of our studies will be provided to RWQB prior to construction.

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, Governor

SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION
30 VAN NESS AVENUE
FRANCISCO, CALIFORNIA 94102-6080
NE: (415) 557-3686

March 7, 1984

Colonel Edward M. Lee
District Engineer
U.S. Army Corps of Engineers
San Francisco District
211 Main Street
San Francisco, CA 94105

SUBJECT: Draft Interim Design Memorandum No. 5 and Environmental Impact Statement for the John F. Baldwin Ship Channel, Phase II, Central San Francisco Bay Segment; State Clearinghouse No. 84011010; Inquiry File MC.MC 7514.1

Dear Colonel Lee:

The BCDC staff has reviewed the above-referenced report, and we have indentified five areas of concern: (1) the effect of disposal of the dredged material at the in-Bay site near Alcatraz; (2) the undetermined effect of the channel deepening on local groudwater; (3) salinity intrusion; (4) the impact of the change in scouring and shoaling patterns adjacent to the channel; and (5) the question of the project's consistency with the Seaport Plan.

1 The first concern we have about the project has to do with the mounding that has occurred at the Alcatraz disposal site. We understand from discussions with the District staff over the last few months, that a mound has formed within the site and reached a level of -30 feet MLLW, that it has shown no signs of significant dispersion even though the District has suspended upstream deposition, and that downstream deposition has apparently contributed to a smaller mound within the "shadow" of the larger one. We know from our discussions with the District staff and from testimony given by the District at the February 16, 1984 public meeting to review this project, that the District intends to correct this problem and is now actively studying methods to alleviate the mounds. We believe that the EIS should acknowledge the mounding since this project would deposit some 8 mmillion cubic yards of material at the site. The EIS should discuss whether the mounding problem will be corrected before this disposal takes place and discuss the amount of sediment retention that can be expected whether or not the mounding at Alcatraz has been corrected. Also, the EIS should discuss the procedures which will be employed to minimize the retention at the site.

In respect to the question of disposal on ebb tide, Section 4 and Section 7 of the EIS appear to be in conflict. Section 4, Subsection 4.03(b)

states:

> "Material will be transported to the existing Alcatraz deepwater disposal site in San Francisco Bay, a distance of seven miles from the project. Each scow will unload upon arrival at the disposal site, irrespective to tidal cycle."

Section 7, Subsection 1.13(a) paraphrases the dredging policies of the San Francisco Bay Plan, stating:

> "Sedimentation resulting from dredging will be minimized by conducting disposal at a designated location where the mmaximum amount will be carried outside the Bay on ebb tide."

The EIS should discuss why the constraint to unload only on the ebb tide will not be observed, state the impacts that will result by unloading on all stages of the tide, and compare the percentage of sediment that will be carried out through the Golden Gate by dumping on ebb tide with the percentage carried out by dumping at all stages of the tide.

2 Our second concern involves the impact that channel deepening may have on local groundwater. Because the EIS does not address the subject of groundwater impact, we are unable to determine if the project would satisfy BCDC's policy on the impacts of dredging projects on groundwater. The policy, dredging Policy No. 6 in the San Francisco Bay Plan, states:

> "To protect underground fresh water reservoirs (aquifers), (a) all proposals for dredging or construction work that could penetrate the mud "cover" should be reviewed by the Regional Water Quality Control Board and the State Department of Water Resources, and (b) dredging or construction work should not be permitted that might reasonably be expected to damage an underground water reservoir. Applicants for permission to dredge should be required to provide additional data on ground water conditions in the area of construction to the extent necessary and reasonable in relation to the proposed project."

Colonel Edward M. Lee
March 7, 1984
Page 3

We think that the Regional Water Quality Control Board and the State Department of Water Resources should comment as to their expectations of possible damage to an underground water reservoir by the proposed dredging. Any expected impact on groundwater is an essential aspect of the Commission's evaluation of the position on the District's consistency determination for the project.

3 One of our basic concerns in the Bay is salinity intrusion. We are concerned that the increased tidal prism resulting from the channel deepening will increase salinity intrusion; however, if your studies show no increased salinity intrusion as a result of this project, we would be satisfied.

4 We are also concerned that the channel deepening may cause changes in the direction or velocity of the currents, which in turn may cause a change in scouring and shoaling patterns. Although the EIS does address the siltation and scouring impacts in the deepened channel itself, it does not speak to any pattern changes outside of the channel. We think there may be some impacts on the nearby shoreline, marinas, and harbors, and that the EIS should discuss those impacts.

5 Lastly, we are concerned that the project be consistent with the Seaport Plan. We would like to advise you that the policies of the Plan encourage channel deepening to make existing ports more useful, so long as the deepening is environmentally acceptable. Accordingly, the project would appear to be consistent with the Seaport Plan, providing that three previous concerns are resolved.

If you have any questions regarding our comments, please contact Norris Millikin, of our staff.

Very truly yours,

FRANK BROADHEAD
Deputy Director

FB:cg

cc: State Clearinghouse
Dr. Gordon Snow

RESPONSES TO SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION

1. Disposal Site: Since being designated in 1972, the Alcatraz Disposal Site (SF 11) has been and remains a viable dredge material disposal site. Prior to 1972, at least eleven different open water areas of San Francisco Bay were used for disposal of dredged material, including the Alcatraz site. In 1972, it was reasoned that reducing the number of sites to the three most suitable

sites this would result in better regulatory control and an increase in dispersion of dredged material out of the Bay system. In reducing the number of disposal sites to just three sites to handle all the dredged material from the Bay projects, it was recognized that the site would experience some biological impacts due to disposal activities. However, it was reasoned that since all three of the disposal sites are located in high energy areas of the Bay, the physical and biological effects would be transitory and more acceptable than disposal in low energy sites. Until recently, the Alcatraz site retained very little of the dredged sediment placed there.

In the fall of 1982, a mound rising from -80 feet (MLLW) to -25 feet (MLLW) was discovered, occupying about 25 percent of the disposal site in its eastern half. Underwater inspection of the mound surface revealed that unauthorized debris (concrete piles, etc., believed to be associated with non-Federal dredging) had been disposed in the concentrated area. This debris in combination with the newly dredged consolidated clays appears to be the cause of the mound formation.

The Corps has been surveying the site every other month for more than a year. These surveys show that there has been a reduction in the volume of the mound material, although only a slight reduction in its height. The sill depth of the mound is at -30 feet (MLLW) as of the March 1984 survey.

The Corps is taking steps to reduce or eliminate the mound problems. Surveys will continue to be conducted at least through fiscal year 1984. All dredging contracts have been notified to dispose only in the western half of the site in deep water and that disposal is limited only to dredged sediments (no debris). In the meantime a U.S. Coast Guard bouy has been placed over the mound to warn mariners.

The mounding is currently the subject of two investigations by the Corps. The Corps' Waterways Experiment Station (WES) is utilizing a numerical model to predict the erodability of dredged materials disposed at the Alcatraz site. The model can predict initial retention and the rate of dispersion based on characteristics of the soil to be dumped, based on the manner in which the material was dredged, and based on currents at the disposal site. This WES study, which is scheduled for completion in July 1984, will provide additional guidance concerning the suitability of specific disposal operations at the Alcatraz site. In addition, the Corps will be conducting a physical investigation of the existing mound in July 1984 to further examine the nature of the material. As part of this investigation, the top ten feet of the mound

will be removed (down to -40 feet MLLW). Large debris will be hauled to an upland site and the sediments will be dumped in deeper water within the Alcatraz disposal site. We anticipate that once the upper portion of the mound is disturbed by the removal of debris and sediment, the mound will naturally erode further to below -40 feet.

Extensive study of dredged material disposal indicate that little additional mounding will occur as a result of Baldwin Phase II disposal. The U.S. Army Corps of Engineers Dredge Disposal Study (1978) which focused on San Francisco Bay and Estuary showed that the water content of the sediment is primary factor in determining if the material will disperse over a large areas or will mound:

> A cohesive sediment and little disturbance (introduction and mixing with water) will descend through the water and mound on the bottom...If the cohesive properties are less because of added water (or higher silt content) the slurry will entrain water during the descent, form a base surge cloud on the bottom, and disperse over a large area (page IV-12).

The construction method for Baldwin Phase II will require disposal of the dredged material in slurry. This produces sediment with the lower cohesive properties which result in dispersion over a wide area. Therefore significant mounding will not occur due to this disposal operation.

Relative to the amount of new work dredging which utilizes Alcatraz for disposal, the material comprising the mound is a small increment. The mound is essentially an anomalous phenomena and there is no evidence to indicate it was present much over two years ago, although disposal has occurred at Alcatraz for approximately 30 years. In addition, the surveys indicate that the mound is being reduced by natural processes and is flattening west toward the Golden Gate. This substantiates previous studies which showed that most of the material disposed of at Alcatraz will move toward the Gate.

The Corps believes that the mound now present at the site is the result of a concentrated disposal of unauthorized debris. When the mound represents a temporary navigation hazard, it does not represent an existing or potential impact on environmental conditions over that envisioned for the site when it was designated as one of three Bay disposal sites.

In summary, the Alcatraz disposal site has proven to be the best available disposal site in San Francisco Bay. The site has been in use for a number of years and mounding has historically not been a problem. The current accumulation of material is apparently a one-time occurrence which may have resulted only because unauthorized debris has been dumped at the site. Control measures governing the use of the site could include restricting material disposed at the site to those in slurry form. This measure would help insure that future mounding would not occur. It could, however, adversely impact some dredging industry in the Bay Area. The monitoring programs which have already been initiated would provide the evidence to support this supposition that slurried material will not mound and would allow future accumulations of material, if any, to be identified immediately. The mounding which has occurred represents a small amount of material relative to the Bay system, and has not caused any environmental or navigational problems.

2. Retention of Dredged Material in the Bay System: A report prepared by the San Francisco District of the Corps entitled "Report of Survey on San Francisco Bay and Tributaries (1967)" based on tests performed on the San Francisco Bay Hydraulic Model indicates that disposal of material at Alcatraz on ebb tide resulted in 80 percent of the material being carried out to sea whereas 47 percent was carried out to sea under unrestricted disposal. Based largely on this data, disposal on ebb tide has been considered for Baldwin Phase II. However, for the following reasons, unrestricted disposal is now the preferred alternative:

a. There is no evidence of environmental impact resulting from disposed material remaining in the Bay system. Tracer studies of dredged material released at the Carquinez Disposal Site showed that the dredged material is dispersed throughout the Bay system at concentrations ranging from .5 percent to 1 percent of the total deposition. In addition, these studies indicate that the Bay bottom is very dynamic substrate since tagged dredge material was found entrained 2 to 3 feet into sediments within a month of release (Dredge Disposal Study, COE, Appendix E, 1976).

b. Model studies are only used to predict the short-term distribution of the dredged material. The model does not simulate waves or currents caused by the wind. The model results provide a gross estimate of the fate of dredged material disposed at the Alcatraz site, and the actual net difference between ebb tide and unrestricted may be less. Because of the uncertainty of this data, it alone cannot justify ebb tide disposal.

3. Groundwater: The proposed deepening will not have any adverse impact on local groundwater quality. Exploration performed during December 1983 and January 1984 consisted of 20 borings along the Southampton Shoal Channel drilled to a mean average depth of 19.3 feet per hole or a median depth of 19 feet. The average elevation of the bottom of the borings based on depth of water, boring depth and theoretical tide at the time of the boring is -60.0 feet MLLW. The sediments encountered were sampled by means of 3 inch diameter Shelby tubes, 3 ft in length. Sampling was conducted at 4 foot intervals or at each distinct soil change by using drilling fluid pressure to extend the Shelby tube into the soil strata. Ten borings (50% of the total) encountered loose to very loose, fine grained, greenish gray, silty sand from the surface of the Bay bottom to or below the 2 foot overdredge limit (-47 feet MLLW). Seven of the twenty borings began in clayey silts to silty clays and did not encounter any sand layers at or below -47 feet MLLW. Those seven borings are located in a reach of the channel that is bounded on both ends by those boring that encountered silty sand between the Bay bottom and -47 feet MLLW. The clayey silts to silty clays are soft to very soft, low to moderate placticity, greenish gray in color and traces of shells are common. Two borings within and near the ends of the reach containing the clayey slits described above began in clayey silts but encountered silty sand above -43.0 feet MLLW. One boring which began in siltv sand encountered clayey silt to silty clay, as previously described at an elevation above project depth of -45 feet MLLW.

Based on the logs of the borings, the looseness of the sands and softness of the clayey silts to silty clays and the presences of shell fragments, it has been determined that the sediments are poorly consolidated or unconsolidated and are equivalent to younger Bay muds. It is reasonable to assume that the water trapped within the sediments during deposition would have a salinity content as high as the salt water from which the sediment was deposited and therefore the in situ water of deposition is of extremely inferior quality. Also, since 50 percent of the boring began in silty sand, salt water has had long enough contact time and opportunity to keep the sands saturated. Thus, dredging will not have any adverse affect on local ground water quality.

4. Salinity Levels: A Corps of Engineers model study and subsequent reports entitled "Hydraulic Model Study for the John F. Baldwin Ship Channel: Incremental Improvement With/Without Fixed Submerged Barriers (1980)" indicates that the Phase II deepening will not result in significant changes in salinity levels at any point in the Bay estuary system. The California Department of Water Resources (DWR Letter 7 February 1980) has reviewed this study and supports the Phase II project.

5. Scouring and Shoaling at the Dredge Site: The project will have a very minimal impact on scouring, shoaling, and on currents. The project will result in an increase in the cross sectional area of the Bay of approximately one percent. The Southampton Channel is in alignment with the San Pablo Strait and therefore subject to high current velocities with little or no cross-current. Maintenance dredging requirements for the project are expected to be 135,000 cubic yards annually, most of which will come from the maneuvering area. Increased shoaling outside the channel will be insignificant. No impact is expected along either shoreline as wind wave forces dominate over the tidal forces in these areas. The equilibrium maintained along the shoreline by the wind wave forces will remain the same as present conditions.

6. Seaport Plan: The Seaport Plan for the San Francisco Bay Area is the result of a cooperative effort sponsored by the Bay Commission and the Metropolitan Transportation Commission (MTC). The Plan responds to state law requiring a maritime element for MTC's Regional Transportation Plan and BCDC's original Bay Plan policy that called for a regional port development plan. The following goals for the Seaport Plan were set by MTC and BCDC:

a. Insure the continuation of the San Francisco Bay Port System as a major world port and contributor to the economic vitality of the San Francisco Bay region.

b. Maintain or improve the environmental quality of San Francisco Bay and its environs.

c. Provide for the efficient use of finite physical and fiscal resources consumed in developing and operating marine terminals.

d. Provide for integrated and improved surface transportation facilities between San Francisco Bay ports and terminals and other regional transportation systems.

The John F. Baldwin Ship Channel Phase II is considered consistent with the San Francisco Bay Area Seaport Plan. The policies of the Plan encourage channel deepening to make existing ports more useful, so long as the deepening is environmentally acceptable. As indicated in the Consistency Determination, the project is considered to be environmentally acceptable.

The project would provide substantial benefits to the San Francisco Bay Port System. Refinery facilities located at Richmond rely on waterborne transportation to supply most of their crude petroleum stocks. Under existing conditions larger tankers must be lightered or wait for high tide to proceed up the channel to the refineries. The proposed channel improvements would rectify this situation. The benefits for the Phase II portion of the John F. Baldwin are computed to be approximately $5.9 million, average annual, based on transportation savings associated with expected crude oil deliveries to the Richmond Refinery over the 50-year life of the project.

ATE OF CALIFORNIA—RESOURCES AGENCY GEORGE DEUKMEJIAN, Governor

EPARTMENT OF FISH AND GAME

NINTH STREET
AMENTO CALIFORNIA 95814
916) 445-3531

March 13, 1984

District Engineer
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, CA 94105

Attention: Environmental Branch

Dear Sir:

The Department has reviewed the Draft Interim Design Memorandum and Environmental Impact Statement for the John F. Baldwin Ship Channel (Phase II, Central San Francisco Bay Segment). The project consists of dredging 1.1 miles of the existing Southhampton Shoal Channel and dredging the Richmond (Chevron) Long Wharf maneuvering area from -35 ft. (MLLW) to -45 ft. (MLLW). An estimated 7,900,000 cubic yards of material would be removed and disposed of at the EPA/COE designated Alcatraz disposal site.

Generally, we find the document to be adequate in its discussion of the economic needs and engineering parameters of the project; however, it is deficient in its description of marine resources at the borrow sites and disposal site and is superficial in its description of impacts to those
1 resources. We recommend that the FEIS contain more site-specific information on fishes and invertebrates, some of which is available in the Fish and Wildlife Service (FWS) Coordination Act Report (Appendix C).

Also of concern to us is the fate of the Alcatraz disposal site. Although some discussion is presented concerning the mounding that has recently developed there, the DEIS is unclear as to what would take place were this problem not to be resolved. We infer from this discussion that all 7.9 million cubic yards will be disposed of in the western portions of the site, but, at the same time, we are aware of alternate sites near the Golden Gate Bridge being investigated
2 by the Corps. The FEIS should identify and discuss thoroughly all alternatives to traditional Alcatraz disposal.

The DEIS also indicates that ebb tide disposal is being considered and that FWS will be providing a supplemental report on the value of this action. We have been in contact with FWS and it is our understanding that they are proceeding with this report. Our Department concurred with their original recommendation (Appendix C) and we continue to support this effort. FWS estimates that
3 approximately 25% less material (2 million cubic yards) would be redistributed around the bay system with ebb tide disposal. The FEIS should have a full discussion of this issue.

Department of Fish and Game personnel are available to discuss our concerns in more detail. To arrange for discussion, please contact Robert Tasto, Associate Marine Biologist, Marine Resources Region, 411 Burgess Drive, Menlo Park, CA 94025; telephone (415) 326-0324.

H. L. Carper
Director

RESPONSES TO CALIFORNIA DEPARTMENT OF FISH AND GAME

1. Section 5.03 of the EIS has been revised to provide more specific information on the Fish and Wildlife species in the project area.

2. The San Francisco Bay Conservation and Development Commission, U.S. Fish and Wildlife Service and the National Marine Fisheries Service shares in this concern. Please refer to the responses provided in answer to their comments concerning the disposal at Alcatraz.

Alternatives to traditional Alcatraz disposal are limited. In-bay disposal outside to the authorized three sites (SF-9, SF-10 and SF-11) can only be accomplished by special permission for a one time disposal event of not more than 50,000 cubic yards per year. Ocean disposal of bay mud is not possible for lack of a EPA designated ocean site. And land disposal was found infeasible for lack of a site outside of tidelands or wetlands. The Corps is interested in the designaion of an ocean disposal site for bay mud and is studying a number of sites located between the Golden Gate to the break of the continenal shelf as alternatives to be presented in a future ocean disposal site designation EIS.

3. A report prepared by the San Francisco District of the Corps entitled "Report of Survey on San Francisco Bay and Tributaries (1967)" based on tests performed on the San Francisco Bay Hydraulic Model indicates that disposal of material at Alcatraz on ebb tide resulted in 80 percent of the material being carried out to sea whereas 47 percent was carried out to sea under unrestricted disposal. Based largely on this data, disposal on ebb tide has been considered for Baldwin Phase II. However, for the following reasons, unrestricted disposal is now the preferred alternative:

a. There is no evidence of environmental impact resulting from disposed material remaining in the Bay system. Tracer studies of dredged material released at Carquinez Disposal Site showed that the dredged material is dispersed throughout the Bay system at concentrations ranging from 0.5 percent to 1 percent of the total deposition. In addition, these studies indicate that the Bay bottom is a very dynamic substrate since tagged dredge material was found entrained 2 to 3 feet into sediments within a month of release (Dredge Disposal Study, COE, Appendix E, 1976).

b. Model studies are only used to predict the short-term distribution of the dredge material. The model does not simulate waves or currents caused by the wind. The model results provide a gross estimate of the fate of dredged material disposed at the Alcatraz site, and the actual net difference between ebb tide and unrestricted may be less. Because of the uncertainty of this data, model studies alone cannot justify ebb tide disposal.

c. Assuming that more material would remain in the Bay system with unrestricted disposal versus ebb tide disposal, the net amount would be insignificant compared to the amount of material brought into suspension by wind and wave forces. Estimates are that each square mile of Bay water area (excluding areas of deep water) suspends 2,200 tons of sediment per day due to

wind and wave forces (Dredge Disposal Study, COE, Appendix B, 1979). This value converts to 6,500 cubic yard per square mile each day. The Bay system has an area of 396 square miles at mean lower low water (MLLW) and 460 square miles at mean higher high water (MHHW). Using the smaller MLLW value and estimating that the 6,500 cubic yards per square mile is generated only for 50 percent of the area (although natural forces resuspend sediment at virtually all points in the system), over the three years that Baldwin Phase II disposal would occur natural resuspension in the Bay would equal approximately 0.5 billion cubic yards. Comparing the amount of dredged material remaining in the Bay system (for unrestricted versus ebb tide disposal) to this value, it can be seen that the amount is insignificant.

Office of
PORT DIRECTOR

City of Richmond

February 15, 1984

Edward M. Lee, Jr., Colonel
Corps of Engineers
District Engineer
Department of the Army
211 Main Street
San Francisco, CA 94105

RE: John F. Baldwin Ship Channel, Phase II, Central San Francisco Bay Segment

Dear Colonel Lee:

I have reviewed the Interim Design Memo No. 5 and Environmental Impact Statement on the above-referenced project. The report reaches conclusions which I believe are favorable to the Port of Richmond. It states that the providing of a 45 ft. depth channel to the Richmond Long Wharf is warranted and that the use and improvement of the existing Southampton Shoal Channel is the best way to accomplish that.

My only exception to the report would be to Paragraph 5.03 on Page 33. This section states that there is a single beneficiary to this project, that being the Standard Oil's Richmond Long Wharf. I do not agree with this and my comment would be as follows:

Although this report on the Phase II, Central San Francisco Bay Segment of the John F. Baldwin Ship Channel indicates a single beneficiary, the Richmond Long Wharf, the ultimate number of beneficiaries will be many. This project incorporates a major portion of another project known as the Deep Draft Navigation Improvements to Richmond Harbor. When this second project is completed, the many (13+) terminals and shipyard located on Pt. Potrero Reach and the Richmond Inner Harbor will benefit greatly from work done on this Central San Francisco Bay Segment.

The two projects overlap in the areas known as the Southampton Shoal Channel and the Long Wharf maneuvering area. The work done is completing this Central San Francisco Bay Segment should considerably reduce the costs of constructing the remainder of the Richmond Harbor Deep Draft Navigation Improvement Project.

Very truly yours,

Sal N. Bose
Port Director

SNB:ERS:mj

cc: City Manager

EIS-63

RESPONSE TO CITY OF RICHMOND

Comments noted.

Chevron

Chevron U.S.A. Inc.
P.O. Box 1272, Richmond, CA 94802

Manufacturing Department
Richmond Refinery
J. K. Murray
General Manager
D. D. Drowley
Manager, Technical Services
R. F. Dennison
Manager, Operations
G. H. Jefferis
Manager, Maintenance
S. A. Starosciak
Manager, E. R. and Admin.
H. E. Holt
Manager, Public
and Government Affairs

March 8, 1984

PHASE II - JOHN F. BALDWIN
SHIP CHANNEL PROJECT

Colonel Edward M. Lee
District Engineer
U.S. Army Engineer District
211 Main Street
San Francisco, CA 94105

Dear Colonel Lee:

Several Chevron representatives were pleased to attend your February 16, 1984 public meeting on Phase II of the John F. Baldwin Ship Channel Project. Chevron fully supports your efforts to provide safer and more economical means of shipping within San Francisco Bay. During the course of this meeting, you reiterated the Corps' request for feedback concerning both the draft Interim Design Memorandum and the draft Environmental Impact Statement. We have the following comments:

Section 4.04 of the Memorandum refers to a 50 ft deep berthing area along the entire face of the wharf. We are reviewing the effect this would have on the wharf's structural integrity. We may consider deepening only those berths currently used for larger vessels.

This same section refers to an assumed joint agreement by which Chevron's berthing area dredging would be incorporated into the Federal contract. We are concerned about the impact dredging operations could have on our daily shipping activities and about the timing of the berthing area dredging portion in relation to completion of the project whole. It may be easier to include our dredging portion within our biennial maintenance dredging. We may therefore wish to privately contract for berthing area dredging. Permitting considerations and the costs of a joint venture vs. a private contract will also need to be considered. We feel that we can mutually work to resolve this area to a satisfactory arrangement.

Please note one more minor comment. In Section 2.02, paragraph 3, you refer to our refinery as the "Standard Oil Richmond Refinery, which is owned and operated by Standard Oil Company of California, Western Operations." In 1977 our domestic oil manufacturing and producing operations were consolidated into a single company, Chevron USA. Our refinery is now known as the Chevron USA Richmond Refinery, which is an operating department of Chevron USA Inc. which is in turn wholly owned

by Standard Oil Company of California.

We look forward to working with your organization. Please contact Mr. R.W. Engstrom at (415) 620-3357 if you have any questions or comments regarding Chevron participation in this project.

Very truly yours,

RB Piritz

RESPONSE TO CHEVRON USA INC

Comments noted. The name of the facility is corrected. The Corps will coordinate the construction schedule with Chevron.

GARY L. GRAY
Attorney & Counselor

525 Prince St., Suite B
Oakland, CA 94610

415/893-4360

March 15, 1984

John H. Eft, District Counsel, & Rod Chisholm, Chief Environmental Branch

U.S. Army Corps of Engineers
San Francisco District
ATTN: SPNPE-R (J.F.B.)
211 Main St.
San Francisco, CA 94105

RE: DEIS for J.F. Baldwin Ship Channel Phase II, Central S.F. Bay Segment

Dear John and Rod:

As discussed at the DEIS hearing on 2-16-84 and by telecon on 2-28-84 and today, there is a significant concern that the DEIS for this project's No. 5) W. Richmond Channel (actually Southampton Shoal Channel) & Richmond Long Wharf does not adequately consider the cumulative impact of the salinity intrusion to be caused by deepening the Pinole Shoal Channel included in the next stage, No. 6) San Pablo Bay & Mare Island Strait, of this regional plan.

The question raised is whether the cumulative impact of the whole San Francisco Bay to Stockton California Project has been evaluated under the principles in Kleppe v. Sierra Club (1976, US) 427 US 409, 96 S Ct 2718, 8 ERC 2159, which requires such consideration for a proposed action, citing NEPA S. 102 (2) (C), because of its cumulative regional impact.

As stated in the Corps's announcement of the hearing, "The San Francisco Bay to Stockton Project was authorized by a 27 October 1965 Congressional resolution approving the modification of five existing navigation projects and construction of a new channel in Carquinez Straits."

The question is not answered in the captioned DEIS where at P. EIS-8, S. 3.02 Single Stage Development it is stated:

(b) Hydraulic model studies of the J.F. Baldwin Ship Channel through Pinole Shoal without mitigation measures have shown increased salinity intrusion throughout Suisun Bay and the lower Delta, as a result of deepening. ....

(c) .... In addition to the environmental effects of a submerged barrier, such as effects on the null zone, movement of aquatic species, water surface elevations and sediment transport have yet to be adequately evaluated.

This statement of inadequate evaluation also raises the necessity of a Worst Case Analysis to avoid unintended consequences.

Your statements at the hearing and in our telecons that the phases are separate, and that the salinity intrusion will be handled in the next step are very helpful. And, it may be accurate that the phases are independent under Webb v. Gorsuch 699 Fed 2d 157.

However, I am not sure that more evaluation is not presently necessary, because Phase II is clearly part of a regional plan whose mutual cumulative impacts may be inevitable, and required to be more fully considered under the Kleppe and Webb cases.

I look forward to the FEIS, and meeting with you informally on 3-38-84 at 1:30 PM on the intrusion studies.

Sincerely,

G.L. Gray

C: Oceanic Society
/ef

RESPONSE TO GARY L. GRAY

Kleppe vs Sierra Club, 427 U.S. 409 (1976), is a case which held that no programmatic EIS was necessary for developing coal reserves on Federal land in the northern Great Plains region because there was no regional plan or program for such development. Webb vs Gorsuch, 699 F.2d 157 (4th Cir. 1983), is a case which looked at EPA permits for the discharge of polluted water associated with the opening of coal mines. The plaintiffs argued that the EIS should have looked at the impact of several other mines planned by the company, but the court held that an administrative agency need consider the impact of other proposed projects when developing an EIS for a pending project "only if the projects are so interdependent that it would be unwise or irrational to complete one without the others."

The San Francisco District believes that the DEIS is adequate with respect to what you refer to as cumulative impacts. Even though the statute which authorizes Phase II also authorizes other upstream work, the Corps of Engineers is not proposing the upstream work at this time. The upstream work admittedly would require more study - for environmental and other reasons. We are engaged in such study but are not prepared to propose the work for some time.

The construction of Phase II would in no way commit the Corps of Engineers to construct the upstream work. Phase II is functionally and economically independent of any upstream work. The shifting of the channel from the West Richmond Channel (authorized) to the Southampton Shoal Channel (proposed in the DEIS) indicates that the Phase II is intended to improve access to the Richmond Long Wharf, and not as a preliminary step for any upstream phases.

The question about a "worst case analysis" relates to impacts of deepening the channel through the Pinole Shoal - upstream of Phase II. As stated above, the Pinole Shoal work is not presently "proposed." It is being studied. This work will not be proposed without adequate scientific information or a worst case analysis, as required by the Council on Environmental Quality regulations at 15 C.F.R. 1502.22.

In summary, the San Francisco District believes that all environmental impacts resulting from the proposed Phase II are adequately discussed in the DEIS and that constructing Phase II does not commit the Corps of Engineers to any future work or impacts not yet discussed in a NEPA document.

7-10 LIST OF PREPARERS

Name and Responsiblity	Expertise	Experience
Rod Chisholm Project Management	Environmental Resources Planner; Water Resources Navigation and Environmental Planning	12 years planning and reports San Francisco District
Harry Erlich Study Coordinator	Economist; Navigation and Water Resources Planning	15 years planning and reports San Francisco District
Frank Best Engineering	Civil Engineer; Navigation and Water Resources Project Design	15 years Design San Francisco District
Gary Hershdorfer Economist	Economist; Navigation and Water Resources Planning	13 years planning and reports San Francisco District
Edward Kandler Cultural Resources	Archaeologist; Cultural Resources Management	4 years planning and reports San Francisco District
Lester Tong Biological Resources	Zoologist; Biological Resources San Francisco District	9 years planning and reports San Francisco District
Robin Mooney Quality Environmental Planning	Civil Engineer; Navigation, Water Resources and	12 years planning Report and reports San Control Francisco District
John Sustar Technical Quality Control	Civil Engineer, Navigation and Coastal Projects, Dredging studies	18 years planning and reports Corps of Engineers

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John F. Baldwin Ship Channel
Phase II
Central San Francisco Bay Segment

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APPENDIX A

ECONOMIC EVALUATION

JOHN F. BALDWIN SHIP CHANNEL
Benefit Evaluation - Phase II

INTRODUCTION

The following provides an evaluation of project benefits for Phase II of the John F. Baldwin Shipping Channel. These benefits are attributable to savings in waterborne transportation costs expected to accrue through the Phase II modification of the John F. Baldwin Ship Channel designed to accomodate deeper draft vessels. While there are seven petroleum processing facilities (six major refineries) located along the channel, the Phase II portion will provide additional dredging to the Richmond Standard Oil Long Wharf. Improvements of the channel to the remaining refineries are to be investigated in Phase III.

SCOPE AND PURPOSE

The purpose of this appendix is to develop an estimate of the benefits for the Phase II portion of the authorized project in order to determine the degree of economic feasibility: i.e., whether or not the benefits exceed the costs and if so by what extent. In addition to presenting the magnitude of the benefits, this appendix also provides some understanding of the underlying economics of waterborne crude oil delivery operations in San Francisco Bay.

CURRENT SHIPPING OPERATIONS

Oil companies as well as other shippers have learned that there exists a potential for achieving economies through the use of larger ships and combination of ships which can lower the per unit transporation cost. This recognition has led the oil companies to take advantage of economic efficiences by sizing their tankers so as to minimize their unit cost. However, the potential for "Economies of Scale" as this practice is called does not necessarily result in the use of the largest technically feasible tankers. Other factors such as quantities needed, refinery capacity, production rates, storage costs, as well as channel depth constraints need to be considered in selecting the optimal, not largest, tankers.

An investigation of recent shipping operations, reveals the following general pattern of deliveries to the Richmond Refinery: 80,000 and 120,000 DWT tankers are used directly from Alaska with lightering in the Bay. For Indonesia crude specially modified 150,000 DWT tankers are typically used; however, rather than coming directly to the San Francisco Bay they are partially offloaded at the company's sister refinery at El Segundo, and then further lighter in San Francisco Bay, before preceding to the Richmond Long Wharf. Finally, domestic crude is delivered from Estero, California in smaller typically 35,000 DWT tankers. Thus, several different basic tankers plus lightering vessels are all used concurrently to service the Richmond Long

Wharf, each considered optimal for its particular use. If any of the conditions underlying this current pattern were to change, oil companies would be expected to reconsider and perhaps alter the operating pattern and array of tankers used so as to optimize the efficiency of the overall operation.

In the case of the Richmond Long Wharf there is under current design two distinct depths to be considered which promotes a two-stage shipping operation. The first consideration is the 55 foot depth at the Bar - or the entrance to the harbor; the second consideration is the 35 foot shipping channel. This disparity in the depths between the Bar and the internal channel causes complex opertaions to be made and in most cases results in the transfer of crude oil from larger ships to smaller lightering vessels once inside the San Francisco Harbor.

BENEFITS

The benefits for the Phase II portion of the John F. Baldwin are computed to be approximately $5.9 million, average annual, based on transportation savings associated with expected crude oil deliveries to the Richmond Refinery over the 50-year life of the project. These are average annual benefits and are in April 1984 price levels. They are computed at the authorized Federal Discount Rate of 3-1/4 percent. The basis for this determination is presented in the following sections.

DEVELOPMENT OF THE PROCEDURE FOR BENEFIT ESTIMATION

In 1973 the South Pacific Division and the North Pacific Division of the U.S. Army Corps of Engineers undertook a study of the deepwater port capabilities along the West Coast. The purpose of this combined effort as stated in the authorizing legislation "was to promote and encourage the efficient, economic and logical development of facilities to accomodate present and future waterborne commerce . . ."1/

In order to estimate the "Economics", that is, the transportation savings that could be realized under various alternative concepts a "Simulation Model of Waterborne Crude Oil Deliveries to the West Coast" was developed.

THE TRANSPORTATION SAVINGS MODEL, DEEPWATER PORT STUDY

The Deepwater Port Study (DWPS) was a major undertaking involving many Divisions of the Corps of Engineers for a 2-3 year period. It produced several reports, one of which was West Coast DWPS, Appendix C, Transportation Economics. Due to the scale and complexity of the study it was decided to invest in developing a sophisticated computer model to simulate crude oil deliveries to the West Coast from various points of origin (supply) and calculate the transportation costs.

1/ Committee on Public Works, H.R., Deepwater Port Study, 12 October 1972.

The computer model, developed specifically for this task, considered every refinery operation located on the West Coast; it grouped the refineries at each port and linked them also by company to permit greater flexibility of the simulated operations. It required specification by company of their sources and quantities of supply. It explicitly considered an entire array of tankers (designated by OCE) four different "modes" of delivery (direct, multiport, lightering, lightloading), the use of tidal delays, and refinery operating conditions. Based on a quantification of these considerations, it determined costs and then selected for each company at each port the least-cost method of delivery. Summing up these costs for each company for various alternatives for specified years, yielded the transportation costs estimates for those years.

Today, the shipping operations of the major oil companies (and many other shippers as well) are planned with the aid of computer analyses incorporating a large number of parameters and alternatives. Given the fact that "the Optimal Ship Transportation Model", similar to the industry approach, had been developed by the Corps of Engineers, it was decided to adapt this model for the John F. Baldwin analysis. The necessary modifications were performed, adding key simulation features associated with the John F. Baldwin, jointly by the developers of the original model and members of the San Francisco District's staff. This computer model, the Optimal Ship Transportation Model, became the primary analytical tool used in the analysis of benefits. A specific discussion of its basic features is presented below.

METHODOLOGY

(The following description is taken from the West Coast Deepwater Port Study amended as necessary to reflect modifications and additions developed for the John F. Baldwin analysis. As throughout this appendix, the emphasis is on the Phase II portion of the work.)

Utilizing the concept of the least-cost fleet, savings in waterborne transporatation costs were computed by minimizing waterborne transportation costs for crude petroleum by treating California as a system of harbors. Each port was considered part of a single California operation for each company. For Phase II, involving one refinery located adjacent to the John F. Baldwin Channel (Standard Oil), there is a two-port operation potential--the El Segundo and Richmond refineries.

The benefits attributable to the deepening of the John F. Baldwin were based on the channel's ability to serve the two-port California operation. In other words for Standard Oil the least cost way to deliver crude oil from its supply sources (Indonesia and Alaska) to both El Segundo and Richmond refineries was developed under current (without project) conditions and for the increased depth for the John F. Baldwin to 45 feet. The total vessel operating costs associated with delivering the petroleum needs under these two conditions were computed. The difference in the total operating costs between the with project and without represented the transportation savings benefit attributable to the project.

The composition of the least cost fleet and the transportation costs under each condition were determined by a computer program, the development of which has been discussed previously. The analysis's logic is described below.

For three separate points in time, 1985, 1995 and 2005, the costs of delivery for crude petroleum from each source to each refinery were minimized. For the Phase II analysis involving Standard Oil there were two separate sources of supply used for delivering to the two refineries. Hundreds of possible means of delivery involving different modes and ship size were computed. The computer program was designed to select the least-cost method of delivery.

A five-step optimization process was used. In the first step, projections of oil deliveries from each source were determined for each refinery. Next, the cargo capacity and the cost of delivering oil from each source were calculated for each size ship and for each of the possible modes of transportation. Specific operations associated with the difference in allowable draft between the Bar and the channel to the Richmond Long Wharf were treated in a separate step. Suboptimal solutions with higher unit costs were then screened. In the final step, all the ship sizes and associated cargoes for all modes of transportation which remained were utilized as input to a linear program which solved for the least cost way to deliver oil from each source to its destination. Each of these steps is discussed in more detail below.

STEPS

(1) Determination of Quantities from Sources to Refinery Locations. Petroleum consumption and supply estimates were obtained for crude oil from each source to each service area. These estimates are based on research involving the company, the industry and appropriate State and Federal agencies. The various data were then compared and individual estimates from source to refinery for future years were developed. This overall estimate reflected a general consensus. See "DATA" section below for added discussion.

(2) Development of Cargo Capacities and Costs. The cost of delivering oil to the West Coast refineries was computed for all possible combinations of modes of delivery for all sizes of ships. Within this step it was necessary to compute the cargo carried by each size ship from each point of origin. Points of origin were either the actual source of oil (such as Indonesia) or the other West Coast port from which the ship was coming. Given the distance to be traveled from the point of origin to the two California harbors, the amount of bunker oil and stores required were computed. Capacity for each size was then computed by deducting the bunker requirements from total ship capacity. For ships with drafts greater than the depths available at the appropriate harbors, the applicable "immersion factor" was used to compute cargo capacity under these conditions. It was assumed that these ships would be loaded at the source at less than full draft. At the same time costs associated with the remaining modes of delivery were developed.

The first mode considered was full and direct shipment from the source to a single port with a direct return. The second mode permitted light-loading at the source. The third was delivery to two ports from the source by offloading some cargo at the first port, continuing to second port to make final delivery, and then returning to the source. The fourth way of delivering oil to a port was to lighter it in a separate vessel from the other port.

For tankers with drafts in excess of channel depth, calculations were made utilizing tidal considerations. In general the use of tidal delays proved "efficient" (less costly) than light-loading. Under this condition large tankers were allowed to rise with the tide which involved a "waiting period", a specified average time associated with the required number of feet of tide.

(3) The San Francisco Bay Subroutine. The limitations of the current channel in the San Francisco Bay were incorporated at this point into the computer program. In the previous step tankers were permitted in San Francisco Bay if they could pass over the San Francisco Bar maintained at a depth of '55 feet (-55 MLLW); 10 feet of clearance is required between the channel and the ship's bottom to allow for large swells.

To account for the lesser depth constraint in proceeding to the refinery through the shallower channel to the Richmond Long Wharf, separate computer analyses (subroutines) were devised to calculate the added cost.

Since the depth at the Bar is greater than through the channel to the Richmond Long Wharf a second optimization procedure is required. This reflects actual current tanker operations where a "large" tanker will enter the Bay and proceed to a prescribed anchorage where it is met by a small tanker. Some or all of the cargo can then be offloaded onto the small tankers (lighters) at which time the ships proceed to the refinery.

This procedure, then, calculates the added cost of delivery from within the San Francisco Bay to the refinery for each possible tanker using three more modes:

(a) Directly, if channel depth permits.

(b) Partial off loading (lightering); tanker proceeds to refinery.

(c) Total offloading with tanker returning to supply source.

Also considered was the use of tides if the ship(s) required added depth. The least cost mode of delivery--including the cost of the lightering ships--to the refinery was added to the operating costs.

(4) Elimination of Sub-optimal and Infeasible Solutions. The fourth step involved in selecting the optimal fleet was to set aside grossly sub-optimal modes of transportation. This was accomplished by identifying the size of ship which cost the least per ton to deliver the oil directly to the port from

each source. The next step was to determine all ships capable of delivering oil to the berths under consideration and identify those which had a lower cost per ton than the least cost ship for making direct full-load deliveries. Consider, for example, a company with refineries in two port areas importing Indonesia oil. For each port, the most economical size ship making direct deliveries from the Indonesian area was chosen whether it was either fully loaded (Mode 1) or light-loaded (Mode 2).

One additional factor was considered at this point -- storage availability. If a ship had capacity greater than 10 days refinery capability, it was not considered feasible to deliver this amount and was excluded from the set of possibilities.

(5) Identification of the Least Cost Mode of Transportation and Fleet. The final step in developing the optimum fleet was to consider these possible low-cost solutions and to solve for the least cost fleet using the simplex method. 1/ The objective was to minimize transportation costs to both ports from each source. The constraints applied guaranteed that at each port, the projected demand for petroleum from that source would be met. The solution possibility set ranged over all sizes of ships, each with associated cargo capacities and costs given the route traveled, the depth at each berth, and the mode of transportation. The solution identified the optimum fleet, the mode of transportation, the number of annual arrivals necessary to meet demand, and the annual waterborne operating cost to transport the petroleum.

COMPUTATION OF BENEFITS

This five-step optimization process was repeated for each source of oil for the Base Case (35 foot channel) and with the 45 foot depth. For each specificed year the transportation costs for the project alternative were subtracted from the base case transportation cost in that year. Analysis was made for three years - - 1985, 1995, and 2005. After year 2005, it was assumed that energy conservation and new energy sources would supply an increasing share of the total energy requirement so that both increases in consumption for energy, as well as possible decreases in domestic oil production, would be offset by these two factors. Therefore, after the year 2005, savings in transportation costs were held constant.

Transportation savings were spread over a 50-year project life, discounted at 3-1/4 percent and brought back to average annual equivalent savings.

DATA

To facilitate the analysis it was necessary to establish initial conditions and develop data based on specific assumptions. When assumptions were made they were supported by detailed background studies to the extent possible. These assumptions are presented below.

(1) Refinery Capacities. The refineries at El Segundo (Southern California) and Richmond were assumed not to increase capacity beyond current

levels. It should be noted that the current output is well below the pre-embargo levels and the these capacities developed at that time should be adequate to produce projected needs.

(2) Commodity Flow (Cargo) Projections. The analyses of benefits significantly depends upon the accuracy to which the future use can be forecast, but the petroleum market has proven to be highly unpredictable since the 1973-74 oil embargo. In fact most experts believe that academically sound projections should not be attempted beyond 1985, the base year of this analysis. In order to develop a reasonable projection, this analysis considers only a 20-year period of growth beyond the base year, 1985-2005. The current market is so uncertain that there would be no real value of more long-range projections; thus, production is the held constant for the project years 2005-2035.

In the projection analysis, the following sources were used: The Department of Energy, Standard Oil representatives, trade journals, and California State Energy Department interpretation of information gathered was applied on a best judgement basis.

PROJECTION ANALYSIS

U.S. oil consumption is generally expected to decrease slightly on a per capita basis to 1995. On the other hand, the growth in population will tend to offset this. Alaskan production has been increasing steadily, but is expected to peak in 1983-1985 and slowly decrease thereafter, barring any new major discoveries.

Some other major developments are: (1) Northern Tier and Isthmus pipelines making it easier to ship Alaskan crude to points east, (2) a glut (probably lasting to 1983-84) of petroleum on the West Coast, and (3) an increase in the amount of California heavy crude through put for the next 30 years. Sources at Standard Oil indicate they will be moving towards greater use of California heavy crude, but will not increase refinery capacity.

On a national level U.S. oil imports are expected to decrease greatly in the future. However, the Richmond refinery has special equipment for blending Indonesian low sulphur crude with the domestic crude. In any case the amount involved is small enough that it will likely remain fairly stable.

According to the California State Energy Office, total crude petroleum demand will increase slightly to the year 2000. This is based on the current attitude within the State office at this time. This projection supercedes the State Offices earlier projection presented in their 1981 biennial report which predicted a slight (6%) decrease from 1985 to 2000.

The assumptions underlying these forecasts are steadily increasing fuel prices, increased conservation, and increased feasibility of alternative energy sources. It should be emphasized that these effects must be pervasive to counter the impact of California's growing population and the increased energy requirements this necessitates.

This would indicate that in terms of total throughput capacity, the refineries around the state will change very little. The changes will occur in the types of crude that can be refined. Presently, the major companies are converting to heavier crude refining equipment.

At present, crude going through California refineries comes from three sources: California, Alaska, and Indonesia/Malaysia. The Alaskan and Indonesian/Malaysian crude is brought in on deep draft-operation vessels. California crude is largely transported by pipeline, although oftentimes crude and processed intermediates are transferred by small tankers.

In summary the analysis of the future petroleum market reveals the following major findings.

a. Petroleum is viewed as a very dynamic market with offsetting trends tending to cancel out each other. "Price" for one is expected to increase in real terms (i.e. over and above inflation) which by itself will cause a decrease in demand.

b. The consensus appears to be a steady market or a slight increase at least for the next twenty years.

c. For the particular refinery involved in Phase II (Standard Oil at Richmond), the projection is for a slight increase over the next 20 years. This is based on the fact that it is a very modern facility capable of efficiently using and mixing California, Alaskan and Foreign crudes to meet U.S. Standards.

*****

Based on this information and cognizant of the fact that the benefit analysis holds oil prices constant, the analysis concludes that a modest (1/2 of 1 percent per year) growth in output is <u>most likely</u>. Other possibilities, no growth, 1% and 2% growth per year, are also included at the end of this section as a sensitivity analysis. The following table presents the actual (1981) and the "most likely" future crude oil shipments for the Richmond refinery.

TABLE 1

ACTUAL & PROJECTED WATERBORNE CRUDE OIL DELIVERIES
RICHMOND
Barrels/Calender Day

	1981	1985	1995	2005-35
Alaskan	120,000	122,400	128,600	135,000
Indonesian	25,000	25,500	26,800	28,000
Domestic	136,000*	136,000*	136,000*	131,000*
Total Production	281,000	284,000	291,000	294,000
Capacity	294,000**	294,000**	294,000**	294,000**

* Estero mix = 24,000; Pipeline = 112,000-expected to ultimately travel entirely by pipeline.

** Actual capacity is 365,000 but held to 294,000 because of Air Control Board restrictions.

EL SEGUNDO
(barrels/day)

	1981	1985	1955	2005-35
Alaskan	140,000	142,800	150,000	158,0000
Indoesian	28,000	28,500	30,000	31,500
Domestic	96,000*	96,000*	96,000*	96,000*
Total Production	243,000	267,000	276,000	285,000
Capacity	334,000**	334,000**	334,000**	334,000**

* Estero mix = 30,000; Pipeline = 66,000

** Actual capacity is 405,000 but held to 334,000 because of Air Control Board restrictions.

Source: Industry Spokesman.

(3) Distances For the long-distance tanker routes from Indonesia, tankers would ply the Great Circle Route. The distances presented below are in nautical miles.

	Alaska	Indonesia
Port to		
San Francisco Bay	1,795	7553
El Segundo	2,109	8042
Port to Port		
El Segundo to San Francisco Bay	344	
Port to Refinery		
San Francisco Bay to Richmond	9	

(4) Depths at Refineries./Channel. These depths used in the analysis are given in MLLW.

El Segundo	55 feet
At San Francisco Bar	55 feet 1/
At Richmond	
(Current)	35 feet
(With Project)	45 feet

Source: Distances Between Parts, H.O. Pub 151, Oceanographic Office; Oceanographic Chart; San Francisco Bay Entrance

(5) Depth of Port Facilities At Source

There would be no constraint on ship size that could not be handled at each of the sources since both harbors at the supply end have deep natural harbors.

(6) Ship Characteristics

a. Twenty-one different foreign and 21 different domestic tankers were considered as described in the tables below.

1/ Requires an additional 5 feet clearance under keel beyond stated 5 feet due to large swells.

TABLE 2
SHIP OPERATING COST DATA
(FOREIGN)

KDWT	COST @SEA ($ HR)	COST @PORT ($ HR)	DRAFT (Ft.)	IMN. FACTOR (Tons/In.)	SPEED (Kts)	FUEL (Barrels/hr)	TIME IN PORT (Hrs.)
25	1095	771	32.0	92	16.0	365	24
30	1132	806	32.5	104	16.0	365	24
35	1169	842	33.0	115	16.0	365	24
40	1244	889	35.3	124	16.0	391	25
45	1319	937	37.6	134	16.0	418	28
50	1394	984	40.0	143	16.0	445	30
60	1477	1057	41.0	164	16.0	605	70
70	1733	1137	42.0	177	16.0	710	30
80	1883	1192	44.0	208	16.0	710	30
85	1910	1221	45.0	211	16.0	735	30
90	1936	1250	46.0	215	16.0	760	30
100	2004	1307	48.0	225	16.0	773	36
110	2072	4363	50.0	235	16.0	786	36
120	2140	1420	52.0	245	16.0	800	36
130	2225	1468	53.0	261	16.0	842	36
140	2310	1515	54.0	278	16.0	883	36
150	2396	1563	55.0	294	16.0	925	36
175	2598	1705	58.5	307	16.0	991	39
200	2800	1848	62.0	320	16.0	1057	42
232	3033	2021	64.5	360	15.5	1125	45
265	3267	2198	67.0	400	15.0	1189	48

Source: 1981 OCE Vessel Operating Costs (Tankers) updated to March 1982. The fixed vessel costs and the operating costs were updated by the factor 1.12 based on the transportation index from January 1981 to March 1982; the fuel costs used was $29/barrel.

TABLE 3
SHIP OPERATING COST DATA
DOMESTIC

KDMT	COST @SEA ($ HR)	COST IN PORT ($ HR)	DRAFT (ft)	IMM FACTOR (TONS/IN)	SPEED	FUEL CONS.	TIME IN PORT
25	2014	1687					
30	2086	1760					
35	2159	1833					
40	2283	1933					
45	2415	2033					
50	2543	2133					
60	2820	2274	(Other characteristics are the same as Foreign Ships)				
70	2956	2359					
80	3081	2439					
85	3153	2490					
90	3226	2540					
100	3354	2657					
110	3483	2774					
120	3611	2891					
130	3772	3014					
140	3833	3137					
150	4094	3261					
175	4460	3567					
200	4827	3874					
232	5254	4241					
265	5681	4608					

Source: 1981 OCE Vessel Operating Costs (Tankers) updated to March 1982 including cost of bunker fuel.

U.S. Ships were used in the analysis of the Alaska oil due to the Jones Act (1920) which required all domestic trade to be shipped on U.S. vessels. Simiiliarity, "lightering" was accomplished with domestice tankers. The Foreign ships which operate at lower cost were used in the analysis of Indonesia oil shipments.

(7) Tidal Conditions. The tidal delays associated with additional feet of tide are developed from tidal curves of the San Francisco Bay. These conditions were applied both at the Bar and for the channel.

To Obtain	Requires (On Average)	
1 foot	0.2	Hours
2 foot	0.8	"
3 foot	1.5	"
4 foot	2.5	"
5 foot	3.6	"
6 foot	12.0	"

SOLUTIONS

The optimal (least cost) solutions reflecting both the existing channel improvements and the proposed improvements are presented below. These solutions are based on the results of the transportation cost model and represent lowest cost means of delivering the alloted amounts of crude oil to Richmond.

1. From Alaska

The optimal solution under current depths (35 feet) calls for the use of 140,000 DWT from Alaska to Richmond, light load at source to pass over the San Francisco Bar and then lightered further into two small 25,000 DWT tankers to lighter the large tanker sufficiently to pass through the channel. The optimal solution with a 45-foot channel also utilizes a 140,000 DWT tanker to bring the crude pil into San Francisco Bay; however; with the deepened channel only one lighter is required.

2. From Indonesia

The optimal Solution under current depths calls for 150,000 DWT from Indonesia to Richmond with a stop first at El Segundo for partial off loading and subsequent lightering in San Francisco Bay. The optimal solution with the John F. Baldwin 45 foot channel reduces the lightering as shown in Table 4.

These optimal solutions are similar to current operations though not identical. The Indonesian operations are the same with 150,000 DWT and a two port mode; the Alaskan operation utilizes somewhat smaller vessels 180,000 and 120,000 versus predicted 140,000 DWT) and proceeds (as predicted) in the direct one port mode.

TABLE 4

OPTIMAL SHIPS, TRIPS AND CARGO - 1985

Ships (DWT) 1/	Trips Per Year (1982)	Short Tons/Trip to: El Segundo	Richmond
1. Base Conditions - 35 foot channel			
a. Supply Area - Alaska			
150,000	48.13	166,600	-
140,000	49.45	-	141,850
25,000 +(2)25,000 lighters			(56,000)
b. Supply Area - Indonesia			
175,000	8.09	181,600	
150,000	9.84	16,100	148,400
(+2 lighters) (25,000, 30,000)			(59,000)
2. Project Conditions - 45 Foot Channel			
a. Supply Area - Alaska			
150,000	48.13	166,000	
140,000	49.45		141,850
(1-25,000 lighter)			(27,000)
b. Supply Area - Indonesia			
175,000	8.09	181,600	
150,000	9.84	16,100	148,400
(1 - lighter 25,000)			(20,000)

Source: Optimal Ship Transportation Cost Model.

<u>Comparision of the Optimal Ship size and the current ships.</u>

The predicted pattern of shipping for the "base case" represents current depths and channel configuration at the Bar and within the Bay. It is, therefore, useful to compare the predicted results for 1985-2035 with the actual 1982 operations. The two waterborne sources expected to continue through the project period are Indonesia/Sumatra and Alaska.

The Indonesian deliveries are identical to the model forecast: With 150,000 DWT tankers using a "two-port operation" with lightering in San Francisco Bay.

1/ DWT is in long tons equaled to 2,240 pounds per ton.

From Alaska the deliveries are direct to San Francisco (identical with the model). A difference with the model, however, is that the actual operation is currently utilizing 120,000 DWTs and 80,000 DWTs versus the predicted 140,000 DWTs.

Given differences between predictive models and the "real world" such differences in results are not considered serious. First of all, the model commences with 1985, not the year of the analysis (1982). The optimazation model assumes an equal availability o. all ships. In the short run this is not necessarily true. Secondly, the model relies on published costs and other data (OCE) which is derived from average values of several ships; the actual ships available for operation may very from those averages and the costs to specific companies might be different even for the same ship. Finally, the model assumes not only that lightering vessels would be available as needed but also at the same costs given by OCE for the small tankers. Possibly this simplification underestimates the real costs for lightering vessels. If the operating costs for lightering are actually greater than used in the model, the tendercy to lighter would be lessened, thus resulting in the use in actually of smaller tankers (less to lighter) than predicted. It should be noted that if the actual costs associated with lightering were greater than used in the project analysis the project benefits would be greater.

AVERAGE ANNUAL BENEFITS

Detailed Transportation Cost Analysis

While the optimal ship transportation cost program (Optimal Ship) provides the least-cost solution to a complex mathematical problem, it does so "without elaboration". That is, many of the specific details associated with the John F. Baldwin solution are not made available as part of its output. In order to identify and display the intermediate results, a second simpler program was written.

The J.F. Baldwin Detailed Cost Analysis program was developed to fulfill a need for more information in the determination of shipping costs for the Phase II study than was available in the existing linear optimal ship program. The two programs are designed to work together. The major distinction between the two programs is that the adopted Deep Water Port Transportation Savings program, given basic parameters, (crude oil demand, ship sizes and their costs, channel depth, etc), determines (using linear programming) the optimal cost ship mix, while the Detailed Cost Analysis program itemizes and displays the transportation costs for any ship mix the user selects.

This second program allows one to choose any ship mix and find the specific transportation costs associated with it. Using the results of this program the total cost underlying the optimal ship selection is better understood. This is meant to be a supplement to the Optimal Ship program and not a substitute.

In the process of optimizing, the Optimal Ship program considers hundreds of possibilities using 21 ships in various combinations and selects the least - cost combination. However, the Detailed Cost Program is better suited for the analysis of different ship mix costs in that it provides detailed results for time and cost of the various aspects of the total transport operation. Thus, once "optional" ships have been selected the Transportation Cost program can provide detailed cost data and sensitivity analysis.

The Detailed Cost Program was developed on the Hewlett-Packard 9830A computer in the BASIC language. The algorithm divides the total trip into time intervals defined by function. For example, the time to load the ship at the source is one interval, the time from source to San Francisco another, and the delay at the San Francisco Bar a third. These intervals are computed for the main ship as well as all the lightering vessels. The time intervals are then multiplied by the appropriate cost per hour factors (either cost at sea or in port) and then summed for the total cost.

In formulating the time intervals, the following factors are considered: vessel speed, fuel consumption, amount light-loaded, wait for tide, time to lighter exclusive of fixed times, tidal affects on speed, and standard time to offload. The vessel data used is current OCE deep draft vessel operating data.

The program is able to compute costs for deliveries to Richmond or El Segundo directly, offloading partially at El Segundo and then coming to Richmond, and various lightering combinations in the San Francisco Bay. The tables presented at the end of the appendix provide the specific cost elements for each of the four optimal trips specificed in Table 5. Namely under the Base Condition (35 feet) from Alaska to Richmond (Table 10) and from Indonesia to El Segundo to Richmond (Table 11) and under Project Conditions (45 feet) from Alaska to Richmond (Table 12) and from Indonesia to El Segundo to Richmond (Table 13).

From this specific information the cost for a delivered ton to the Richmond Refinery is obtained. As the effects on the El Segundo Refinery are the same with and without the project, the analysis concentrates on the difference in the cost for a delivered ton at Richmond. As can be seen from these tables, the savings involve a reduction in lightering needs with the enlarged channel.

Summarizing this information we can determine that the cost per trip and cost per ton delivered to the Richmond Refinery.

TABLE 5
COST PER TRIP

CHANNEL	ALASKAN	INDONESIA
35'	$1,314,700	$2,706,300
45'	$1,221,700	$2,623,300
Savings:	$ 93,000	$ 83,000
Tons:	141,850	148,240
Savings per ton:	$0.65	$0.56

Source: Detailed Cost Program (actual ships determined in optimizing program.)

Inserting these savings with the projected tonnage to the Richmond Refinery from each source yields the estimated project savings. These benefits are shown in the following tables.

TABLE 6

TRANSPORTATION SAVINGS
(1982 Prices)

SOURCE:	ALASKA			INDONESIA			COMBINED TOTAL
	Savings* Per Ton	Tons Per Year (000)	Savings Subtotal ($000)	Savings* Per Ton ($)	Tons Per Year (000)	Savings Subtotal ($000)	Savings (Undis- counted) ($000)
1985	0.65	6,873	4,467	0.56	1,432	802	$5,269
1995	0.65	7,221	4,694	0.56	1,504	842	5,535
2005-2035	0.65	7,580	4,927	0.56	1,543	864	5,791

*Note: Savings per ton based on the differences in cost per trip delivered to Richmond: 141,850 s.t. from Alaska; 148,400 s.t. from Indonesia.

TABLE 6-A
TRANSPORTATION SAVINGS
1984 1/

	1982 Prices ($000)	Index	Current 1984 Prices ($000)
1985	5,269	1.06	5,587
1995	5,535	1.06	5,869
2005-2035	5,791	1.06	6,141

1/ Update from October 1982 to April 1984 using a composite index on fuel (20%), capital (50%) and labor (30%).

TABLE 7

ANNUAL DISCOUNTED BENEFITS
(April 84 Price Level)

YEAR	UNDISCOUNTED SAVINGS	DISCOUNT 3-1/4	DISCOUNT 8-1/8	SAVINGS 3-1/4	SAVINGS 8-1/8
1985	5,587,000	.1636	.2960	$ 916,000	$1,654,000
1995	5,869,000	.2982	.3991	1,749,000	2,342,000
2005-2035	5,141,000	.5382*	.3149*	3,304,000	1,934,000
				$5,969,000	$5,930,000

*Note: Factor is sum of factors years +20 to +50.

Sensitivity Analysis on Commerce Projections.

Project benefits are based on the most "probable" future conditions. As such a projected growth rate in crude petroleum use of one-half percent per year is used in the with and without analysis of project benefits. However, risk and uncertainty is also addressed in this section through a sensitivity other analysis of several other levels of projections.

In addition to the base case annual growth rate (one-half percent), other rates were considered. Starting with the current year (1982) projections were made under conditions of "no growth" (zero percent), one percent and two percent per year. As with the base case analysis, projections of growth were made only for the first 20 years of project life due to extreme uncertainty of the basic parameters (price, demand , supply and alternative energy sources.) Since it is not anticipated that the project will induce growth the same projections are used in the with and without cases.

Presented below (Table 8) are the projections of waterborne crude oil deliveries to the Richmond refineries based on four different rates of growth to the year 2005. Table 9 displays the Average Annual Equivalent Benefits for these four projected rates of growth.

TABLE 8

PROJECTIONS in BBls/DAY & S.TONS/YR.
Sensitivity Analysis of Waterborne Projections,
Alternative Projected Future Deliveries, Richmond Refinery.

(BARRELS/DAY)

Annnual Growth Rate	1985	1995	2005-2035
0	145,000	145,000	145,000
1/2%(Base Projection)	147,000	155,400	163,000
1%	151,000	164,700	184,000
2%	157,000	191,000	233,000

(TONS/YEAR)

	1985	1995	2005-2035
0	8,142,600	8,142,600	8,142,600
1/2%(Base Projection)	8,305,500	8,726,000	9,153,000
1%	8,479,000	9,248,000	1,033,000
2%	8,816,000	10,725,000	13,084,000

TABLE 9

AVERAGE ANNUAL EQUIVALENT BENEFITS 1985-2035
(April 1984 Price Level)

UNDER VARIOUS RATES OF GROWTH
SENSITIVITY ANALYSIS

Growth Rate	Average Annual Equivalent Benefits @ 3-1/4% ($000)
0% (No growth)	$5,300
1/2 (Base Case)	5,936
1%	6,572
2%	7,840

DETAILED COST DATA

Tables 10-13

Table 10

PHASE II ALASKA 35 FEET

MAIN SHIP	HOURS	COST
LOADING AT SOURCE	36	112932
SOURCE TO SF ANCHORAGE	112.062	429533.64
TIDAL DELAY AT SF BAR	3.55646	13631.911
LIGHTERING IN BAY	19.9285	62515.704
TIDAL DELAY AT CHANNEL	3.63303	13925.403
SF ANCHORAGE TO PORT	1.28571	4928.1264
OFFLOADING CARGO	36	112932
PORT TO SF ANCHORAGE	1.28571	4928.1264
SF ANCHORAGE TO SOURCE	112.062	429533.64

SUM OF COSTS FOR MAIN SHIP		1184860
LIGHTERS		
LIGHTER # 1		
PORT TO SF ANCHORAGE	1.28571	2589.4199
LIGHTERING IN BAY	10.4642	17653.105
TIDAL DELAY AT CHANNEL	0.8	1611.2
SF ANCHORAGE TO PORT	1.28571	2589.4199
OFFLOADING CARGO	24	40488

SUM OF COSTS FOR LIGHTER # 1		64931.145
LIGHTER # 2		
PORT TO SF ANCHORAGE	1.28571	2589.4199
LIGHTERING IN BAY	10.4642	17653.105
TIDAL DELAY AT CHANNEL	0.8	1611.2
SF ANCHORAGE TO PORT	1.28571	2589.4199
OFFLOADING CARGO	24	40488

SUM OF COSTS FOR LIGHTER # 2		64931.145
SUM OF COSTS FOR ALL LIGHTERS		129862.29
TOTAL COSTS		1314722.8

Table 11

PHASE II INDONESIA 35 FEET

MAIN SHIP	HOURS	COST
OADING AT SOURCE	36	56268
OURCE TO EL SEGUNDO	502.625	1204289.5
FFLOADING AT EL SEGUNDO	13.4969	21095.654
L SEGUNDO TO SF ANCHORAGE	21.5	51514
IDAL DELAY AT SF BAR	3.55989	8529.4964
IGHTERING IN BAY	19.8199	30978.503
IDAL DELAY AT CHANNEL	3.56002	8529.8079
F ANCHORAGE TO PORT	1.28571	3080.5611
FFLOADING CARGO	36	56268
ORT TO SF ANCHORAGE	1.28571	3080.5611
F ANCHORAGE TO SOURCE	472.062	1131060.5

UM OF COSTS FOR MAIN SHIP		2574694.6

LIGHTERS

IGHTER # 1		
ORT TO SF ANCHORAGE	1.28571	2589.4199
IGHTERING IN BAY	10.1666	17151.054
IDAL DELAY AT CHANNEL	0.8	1611.2
F ANCHORAGE TO PORT	1.28571	2589.4199
FFLOADING CARGO	24	40488

UM OF COSTS FOR LIGHTER # 1		64429.094

IGHTER # 2		
ORT TO SF ANCHORAGE	1.28571	2681.9910
IGHTERING IN BAY	10.6532	18749.632
IDAL DELAY AT CHANNEL	0.399828	834.04120
F ANCHORAGE TO PORT	1.28571	2681.9910
FFLOADING CARGO	24	42240

UM OF COSTS FOR LIGHTER # 2		67187.655

UM OF COSTS FOR ALL LIGHTERS 131616.74

OTAL COSTS 2706311.3

Table 12

PHASE II ALASKA 45 FEET

MAIN SHIP	HOURS	COST
LOADING AT SOURCE	36	112932
SOURCE TO SF ANCHORAGE	112.062	429533.64
TIDAL DELAY AT SF BAR	3.55646	13631.911
LIGHTERING IN BAY	15.4642	48511.195
TIDAL DELAY AT CHANNEL	1.15186	4415.0793
SF ANCHORAGE TO PORT	1.28571	4928.1264
OFFLOADING CARGO	36	112932
PORT TO SF ANCHORAGE	1.28571	4928.1264
SF ANCHORAGE TO SOURCE	112.062	429533.64

SUM OF COSTS FOR MAIN SHIP		1161345.7

LIGHTERS		
LIGHTER # 1		
PORT TO SF ANCHORAGE	0.5625	1132.875
LIGHTERING IN BAY	10.4642	17653.105
TIDAL DELAY AT CHANNEL	0	0
SF ANCHORAGE TO PORT	0.5625	1132.875
OFFLOADING CARGO	24	40488

SUM OF COSTS FOR LIGHTER # 1		60406.855
SUM OF COSTS FOR ALL LIGHTERS		6046.8544
TOTAL COSTS		1221752.5

Table 13

PHASE II INDONESIA 45 FEET

MAIN SHIP	HOURS	COST
OADING AT SOURCE	36	56268
OURCE TO EL SEGUNDO	502.625	1204289.5
FFLOADING AT EL SEGUNDO	13.4969	21095.654
L SEGUNDO TO SF ANCHORAGE	21.5	51514
IDAL DELAY AT SF BAR	3.55989	8529.4964
IGHTERING IN BAY	13.9761	21844.644
IDAL DELAY AT CHANNEL	3.49465	8373.1814
F ANCHORAGE TO PORT	1.28571	3080.5611
FFLOADING CARGO	36	56268
ORT TO SF ANCHORAGE	1.28571	3080.5611
F ANCHORAGE TO SOURCE	472.062	1131060.5

UM OF COSTS FOR MAIN SHIP		2565404.1

LIGHTERS

IGHTER # 1		
ORT TO SF ANCHORAGE	0.5625	1132.875
IGHTERING IN BAY	8.97619	15142.832
IDAL DELAY AT CHANNEL	0	0
F ANCHORAGE TO PORT	0.5625	1132.875
FFLOADING CARGO	24	40488

UM OF COSTS FOR LIGHTER # 1		57896.582

UM OF COSTS FOR ALL LIGHTERS 57896.582

OTAL COSTS 2623300.7

APPENDIX B
SECTION 404 (b) OF THE CLEAN WATER ACT
EVALUATION

APPENDIX B
Section 404 (b) odf the Clean Water Act
Evaluation

I. Project Description

a. Location. The proposed disposal site for the dredged material is in open water south of Alcatraz Island in San Francisco Bay. The dredging sites are the connecting channel across Southampton Shoal and the Richmond Long Wharf. See Figure 404-1 for dredging sites.

b. General Description. The project is described in detail in the Interim Design Memorandum and Environmental Impact Statement.

c. Authority. The San Franciscoi Bay to Stockton ship channel was authorized in Public Law 89-298 adopted 27 October 1965.

d. Dredged Material:

(1) General characteristics of material. The material from Southampton Shoal is 35 - 40 percent fine sand and 60 - 65 percent finer material. The material from the Long Wharf maneuvering area is (average of 3 core samples) 29 percent clay, 40 percent silt and 31 percent fine sand.

(2) Quantity of Material. The initial dredging required for the project is 9 million cubic yards. Annual maintenance dredging is estimated to be 50,000 cubic yards after the project is complete.

(3) Source of Material. The material to be disposed would be excavated from the Southampton connecting channel and the Long Wharf maneuvering area. The source of materila is alluvial deposits.

e. Description of the Proposed Discharge Site:

(1) Location. The proposed discharge site is the western half of the Alcatraz disposal site south of Alcatraz Island in San Francisco Bay. The center of the disposal site is at coordinates 37° 49' 17"N and 122°25'23"W See Figure 8 of the main report.

(2) The Alcatraz disposal site is circular with a radius of 1000 feet. Only the western half of the site is planned to be used. The surface area of this half of the site is 0.06 square miles. Water depths range from 80 - 115 feet.

(3) Type of Site. The discharge site is an unconfined open water site with high cudrent energy.

(4) Type of Habitat. The natural bottom sediment is composed of coarse sand. However, the site is currently covered with consolidated fine grained sediment from discharges of consolidated material dredged from new projects, and unauthorized disposal of construction debris.

(5) Timing and duration of discharge. For authorized project, initial dredging is estimated to last three years. Dredging and disposal would be continuous year round.

f. Disposal Method. The dredging method will break up the dredged material and mix it with ambient water. Disposal of the resulting slurry would be from a barge or hopper dredge.

II. Factual Determination

a. Physical Substrate Determinations

(1) Substrate Elevation, Slope and Composition. Water depths at the western half of the Alcatraz disposal site range from 80-115 feet. A large mound of discharged material is present in the eastern half of the site, and disposal in this area has been discontinued. The depth of the highest portion of the mound is currently 31 feet. A U.S. Coast Guard buoy has been placed at the site, and a notice to mariners has been published to warn of the shallow depths.

The corps believes that the mound is the result of concentrated disposal of unauthorized debris and consolidated dredged material. The mounding is currently the subject of two investigations by the Corps. The Corps' Waterways Experiment Station (WES) is using a numerical model to predict the erodability of dredged materials disposed at the Alcatraz site. The model will predict initial retention and the rate of dispersion based on a) characteristics of the soil to be dumped, b) the manner in which the material was dredged, and c) currents at the disposal site. The WES study, which is scheduled for completion in July 1984, will provide additional guidance concerning the suitability of specific disposal operations at the Alcatraz site. In addition, the Corps will conduct a physical investigation of the existing mound in July 1984, to further examine the nature of the material. As part of this investigation, the top ten feet of the mound will be removed (down to -40 feet MLLW). Large debris will be hauled to an upland site and the sediments will be dumped in deeper water within the Alcatraz disposal site.

No significant mounding of the disposed material from this project is anticipated. The cutterhead of the dredge will break up the consolidated dredged material into a slurry with small clumps (approximately 5" diameter) which will be mixed with ambient water and transported by pipeline to the disposal barge or hopper bin. Studies conducted as part of the Dredge Disposal Study (COE, 1975) investigated the behavior of the dumped material as a function of sediment type, water type, vessel configuration, water depth, percent sediment moisture, and volume of material. The study results indicated that moisture content was the primary variable determining behavior of the dumped materials. The Dredged Disposal Study also examined the effects of transport on the disposal slurry. The study found that vibrations during transport have little effect on the moisture content of the material. The high water content of the slurry mixture resulting from the action of the cutterhead will decrease the potential for mounding and enhance dispersion of the disposed material at the site.

The disposal site is in an area of high tidal velocities. A recent model study (COE, in preparation) of current velocities in the area predicted maximum bottom velocities of up to 3.15 m/sec on a spring tide with high Delta outflow. Bottom currents tended to the west-southwest. Some of the larger sized material may fall through the water column and mound temporarily on the site bottom during slack tide. The tidal velocities predicted for the site should be sufficient to resuspend and transport the material settling on the bottom. Model studies (COE, 1967) of disposal of unconsolidated fine grained material (silt and clay) at the site have shown that most of the material moves out of the bay system through the Golden Gate. Initial movement of the disposed material was predicted by the model as follows:

% Dredged Material	Location
47	outside the bay via the Golden Gate
1	extreme southern end of the south bay
21	between SF International Airport and the Bay Bridge.
27	Central Bay
3	San Pablo Bay
1	Carquinez Strait

The material that remained in the Bay (53%) was deposited principally in the shallow regions of the Bay.

The disposed sandy material would become part of the bedload transport system on the bay bottom and would move between the Golden Gate and Racoon Straights with prevailing currents. Benthic organisms in high energy areas such as the disposal site are sparse and unsually adapted to shifting sediments. Due to the small percentage of dredged material that would fall to the site bottom, and the ability of the animals to survive in a shifting substrate, burial of benthic organisms by short term mounding of dredged material would not be significant.

The depths at the disposal site will be monitored monthly. In the unlikely event that mounding of discharged material is detected at the site, the disposal could be modified by one of the following methods:

- Modification of the dredging operation to increase the water or air content of the dredged material slurry,

- Relocation of the disposal site,

- Cessation of the disposal (and dredging) activity.

b. Water Circulation, Fluctuations and Salinity Determinations.

(1) Water. The proposed disposal activity will not result in any change in salinity, water chemistry, color, nutrients, odor, or temperature. Monitoring of disposal of dredged material from a barge during the dredge disposal study (DDS)(COE, 1976) did not indicate that there was any

significant change in any of these parameters. However, the monitoring study indicated tht the concentration of dissolved oxygen was affected by dredged material disposal. The dissolved oxygen concentration was reduced at the surface by approximately two parts per million and lasted approximately two minutes. Near the bottom of the water column, sediment disposal can cause a significant oxygen depletion with each release. REductions of up to six parts were million were observed in the DDS. Ambient concentrations were regained after an average of three to four minutes, but could last as long as eleven minutes. The direction and intensity of these fluctuations is determined by the chemical composition of the material, its contactable surface area and by areation resulting from mechanical perturbations during the operation. The duration of the dissolved oxygen reduction is controlled by the contact time between sediment and water and by the intensity of the initial demand.

The turbulent nature of the disposal site and the rapid dilution of the released material will minimize the duration and intensity of the depression. The oxygen demand of the sandy sediment should be relatively low. The finer grain material could cause oxygen depressions similar to that detected in the DDS. The impact upon the water column would be intermittant due to discontinuous disposal from the bardge or hopper dredge.

(2) Current Patterns and Circulation. Strong ambient currents indicate no change in current patterns velocities or stratification of the water column, will occur from dredge material disposal.

(3) Normal water level fluctuations. No change in water levels or salinity gradients would occur.

c. Suspended Particulate/Turbidity Determinations

(1) The proposed method of disposal is by barge or hopper dredge with bottom dump of the dredged material slurry. This method will minimize the amount of material that mounds on the disposal site bottom and will maximize the dispersal of the material in the water column. Tidal energies can be quite high. The recent model study (COE, in preparation) indicated that current velocities can range up to 3.15 m/sec at the bottom during a spring tide with high Delta outflows. The duration of each discrete dump would last approximately two minutes; dispersion of sediments from the disposal site occurs in about 15 minutes with ultimate assimulation into the bay sediment regime.

(2) No significant effects on chemical and physical properties of the water column are expeced from the proposed disposal. Due to the location of the site in an area of high water mass movement, dispersion of sediments occurs rapidly, reducing any concentation of high suspended solids, the duration of dissolved oxygen depressions and the potential for maximum release of any chemical pollutant at any one location.

During disposal, short term effects would be expected to occur with each discharge of the barge or hopper load. Increased turbidity would decrease light transmission and would develop a plume upon release. Primary production

by phytoplankton could be reduced. Direct effects upon nekton (free swimming animals) would be limited to those directly under the disposal vessel. Sight feeders could be indirectly affected by the reduced light transmission. Mobile animals may be attracted to the disposal area to feed upon organisms in the dredged material.

(3) Suspended particulate bioassay testing of the dredged material from the Richmond Long Wharf was performed to determine the potential impacts of the suspended material upon water column organisms. The bioassay and analytical preocedures are explained in EPA/COE (1977). Three marine organisms were assayed, *Acartia tonsa* (copepod), juvenile *Crangon nigricauda* (shrimp), and *Parophrys vetulus (fish)* at various concentrations of suspended dredged material for 96 hours. Survival of *Arcartia tonsa* and *Crangon nigricauda* exceeded 50% in all experimental treatments, so the limiting permissible concentration (LPC)1/ would not be exceeded upon disposal.

For *Parophrys vetulus*, survival was less than 50% in both the 50% and 100% concentration test treatments. LC_{50} values (the concentration that is lethal to 50% of the test organisms) and 95% confidence limits were calculated and a time concentration morality curve was plotted from these values. The time concentration morality curve was compared to the expected dilution of the dredged material at the disposal site after four hours to determine if the LPC might be exceeded in the field.

EPA/COE (1977), recommends that the concentration of suspended dredged material not exceed 1% of the lower 95% confidence limit of the LC_{50} curve was 20% (MRC 1981). Therefore, the concentration of susoensded particulate dredged material (Csp) should not exceed 0.2%. The (Csp) for three dredged material samples was calculated using the following formula:

$$Csp = \frac{Vsp}{Vm} \times 100$$

where:

C sp = Concentration of suspended material in percent.

V sp = Volume of suspended material (calculated fdrom the volume of material contained in one disposal barge and the percent fine grained sediment in the dredged material.

V m = Mixing volume (calculated using mixing volumes for clay, silt and sandy material as presented in COE, 1978).

The C sp calculation was made for three representative dredged material cores. The C sp values for all three cores was 0.14%. Since the Csp values were less than 0.2% it is concluded that the disposal of the dredged material would not produce environmentally unacceptable impacts in the water column. The C sp calculations are found at the end of this evaluation.

1/ LPC is a concentration that will not cause unreasonable acute or chronic toxicity or sublethal adverse effects. The LPC is calculated from the LC_{50} values (Lethal concentration to 50 percent of the sample).

d. Contaminant Determinations. Sediment core samples were taken of the three channel areas proposed dor dredging to the project depth plus allowable overdepth. All core samples that consisted of greater than 20% fine grained material by weight (finer than a standard 200 sieve) were subjected to elutriate analysis for the following contaiminants: oil and grease, petroleum hydrocarbons, mercury, lead, zinc, cadmium, copper, polychlorinated biphenyls (PCB's) and total identifiable hydrocarbons (TICH). Theelutriate tests followed the procedures outlined in the manual (EPA/COE, 1977). Elutriate results are presented in Table 1 as are the results of the water chemistry analysis of the receiving water and the applicable state and Federal criteria. Sediment sampling locations are shown on Figure 404-1. As shown in Table 1, neither state or Federal criteria are exceeded fro the following contaminants: oil and grease, mercury, lead, zinc, cadmium, and copper. The deected levels of Polychlorinated bipheyls (PCB's) and total identifiable chlorinated hydrocarbons (TICH) meet state criteria, however, the detection limit of the equipment used for some of the PCB tests exceeds EPA guidelines. No state or Federal criteria has been established for residual petroleum hydrocarbons, so the detected levels in the dredged material were compared to the ambient water quality at the disposal site. The hydrocarbon levels at both the dredge and disposal sites were below the detection limits of the laboratory equipment used in the tests. It is therefore concluded that disposal of the dredged material meets all the applicable water quality standards.

e. Aquatic Ecosystem and Organism Determinations:

(1) Effects on Plankton. The temporary increase in ambient turbidity from disposal will reduce light transmission through the water column which could in turn reduce photosynthesis by phytoplankton. As the disposed material will be rapidly dispersed, the impact will not be significant.

The impact of the suspended material upon a representative zooplankton was tested in the suspended particulate phase bioassay test described earlier. The test did not indicate any significant potential impact upon species tested (*Acadrtia tonsa*).

(2) Effects on benthos. As the disposal site is in a high energy area, and the sediment will be discharged as a slurry, very little of the disposed dredged material is expected to reach the site bottom. Impact upon benthos is considered insignificant.

(3) Effects on nekton. Suspended particulate phase bioassay testing was performed on *Parophrys vetulus*, a representative bottom fish species. As described unde section C.3 above, the test results indicate that the effects of the suspended particulate in the water column upon the fist would meet current regulatory requirements. It is expected that most nektonic organisms will be able to move to avoid the discharge plume.

(4) Effects on Aquatic Food Web. The resuspension of the dredged material at the dredging site for the duration odf the construction phase was of concern to resource agencies. Bioaccumulation testing of the dredged

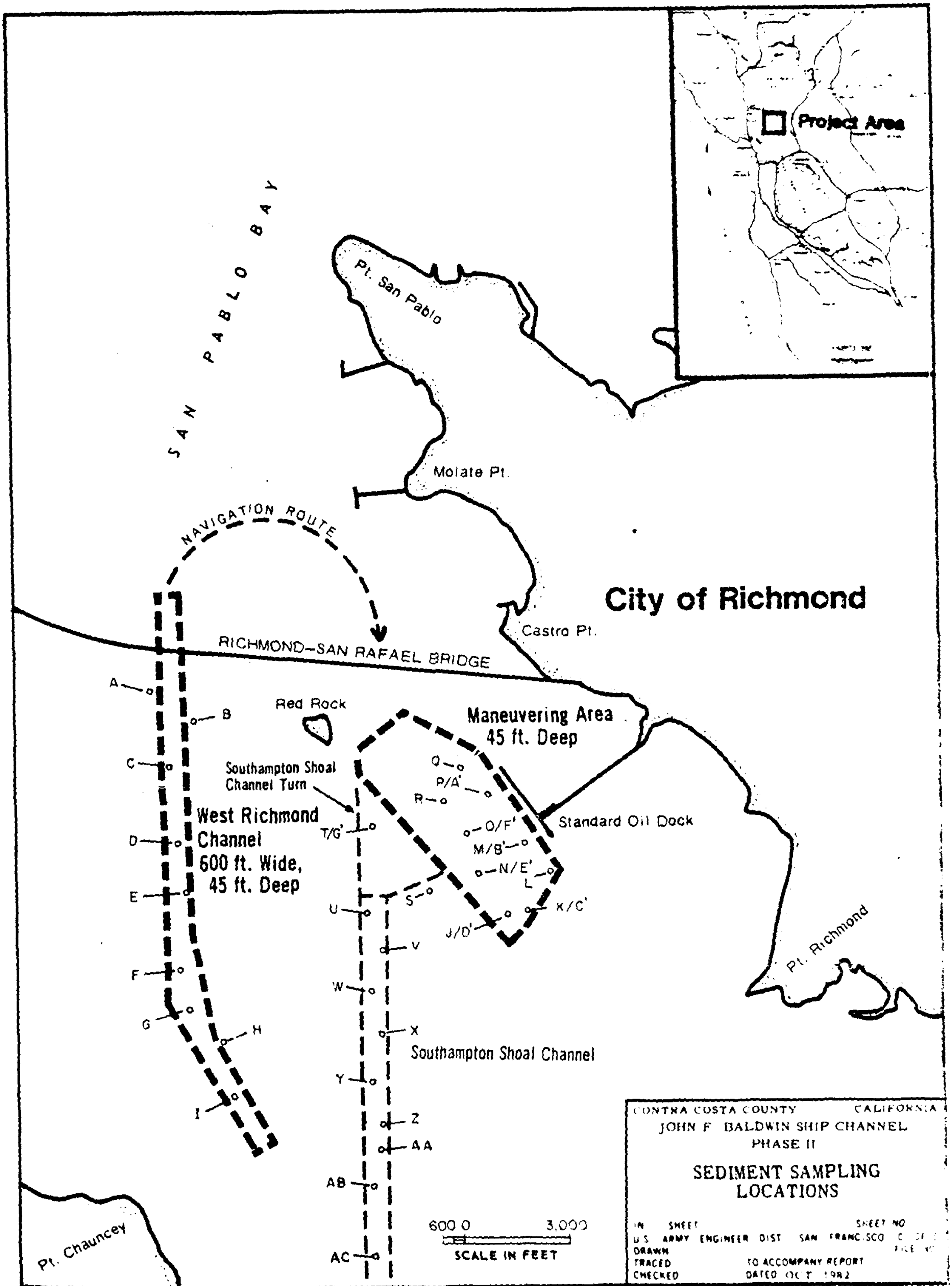
Project Area
SAN PABLO BAY
Pt. San Pablo
Molate Pt.
NAVIGATION ROUTE
City of Richmond
Castro Pt.
RICHMOND–SAN RAFAEL BRIDGE
Red Rock
Maneuvering Area
45 ft. Deep
Southampton Shoal
Channel Turn
Standard Oil Dock
West Richmond
Channel
600 ft. Wide,
45 ft. Deep
A
B
C
D
E
F
G
H
I
Q
P/A'
R
O/F'
M/B'
N/E'
L
K/C'
J/D'
S
T/G'
U
V
W
X
Y
Z
AA
AB
AC
Southampton Shoal Channel
Pt. Richmond
Pt. Chauncey
600 0
3,000
SCALE IN FEET
CONTRA COSTA COUNTY
CALIFORNIA
JOHN F BALDWIN SHIP CHANNEL
PHASE II
SEDIMENT SAMPLING
LOCATIONS
U.S. ARMY ENGINEER DIST SAN FRANCISCO
DRAWN
TRACED
CHECKED
TO ACCOMPANY REPORT
DATED OCT 1982

FIGURE 404-1

material was performed to assess the potential for uptake of contaminants resuspended in the turbidity plume at the dredge site by filter feeding animals. Testing was performed for cadmium, copper, lead, mercury, zinc, total identifiable hydrocarbons (including PCB's) and petroleum hydrocarbons.

The Japanese little neck clam Tapes Japonica, a filter feeder was used for the test. There were three treatments: the experimental treatment, a reference, and a control. The test consisted of two phases: uptake and depuration. During the uptake phase of the test, in the experimental treatment, the clams were held in reference sediment collected approximately 1.5 miles southeast of the dredge site. Dredged material was suspended in sea water which was circulated through the experimental tank. In the control treatment, the clams were placed in unpolluted fine grained control sediment and unalteed sea water was circulated through the tank. In the reference treatment, the clams were held in clean reference sediment and reference sediment was suspended in seawater circulated through the tank. The uptake phase lasted 10 days.

After the uptake phase, the clams were all placed in control sediment in sea water dfor a 10 day depuration phase. Statistical analysis of the experimental data did not indicate significant uptake of any of the tested chemicals in the experimental treatment. The testing did not indicate the potential for bioaccumulation of any of the contaminants tested (MBL, 1982).

(5) Effects on Special Aquatic Sites. The dredging site is an unvegetated subtidal area. The disposal site is subtidal with a sand/mud bottom. The proposed activity will not effect sanctuaries or refuges, wetlands, mud flats, vegetated shallows, coral reefs, or riffle and pool complexes.

(6) Threatened and Endangered species. The proposed project will not impact any Federally listed threatened or endangered species. In a letter dated 2 April 1982, the U.S. Fish and Wildlife Service indicated that there are no listed or proposed species within the project area.

f. Proposed Disposal Site Determinations.

(1) Mixing zone determination. The dredged material will be sufficiently diluted within the authorized mixing zone (as defined in Supplemental Regional Procedures Evaluating Discharge of Dredged or Fill Material into Waters of the United States, SF COE July 1979) to meet all applicable state and Federal water quality criteria.

(2) The proposed discharge will meet all applicable State and Federal Water Quality criteria.

(3) Potential effects on human use characteristics. The proposed project will not have an unacceptable adverse effect on municipal water supplies, shellfish beds, fisheries, wildlife or recreation areas.

g. Determination of Cumulative Effects on the Aquatic Ecosystem.

Dredging of navigation channels and discharging at one of the three disposal sites in the Bay, has the effect of redistributing the sediment within the system. Corps estimates of dredged material placed into suspension with the San Francisco Bay averaged over a 100-square-mile area is about 400 cubic yards per square mile per day of dredging and disposal. For comparison, the amount of sediment suspended by wave action in shallow water has been estimated to be 6,500 cubic yards per square mile per day (for days when wind is 10 knots or greater)(COE, 1977).

Roughly 3.5 million cubic yards of dredged sediments are discharged at Alcatraz from current Federal (civil and military) maintenance dredging projects annually and 1 million cubic yards are discharged annually at the site by private parties under Department of the Army Permits. Implementation of several additional pending navigation improvement projects in San Francisco Bay plan disposal at Alcatraz. The proposed deepening of the Oakland Outer Harbor channel will require 4.85 million cubic yards of dredging. Annual maintenance requirements will increase by 90,000 cubic yards. The recommended deepening of Oakland Inner Harbor Channel would result in initiall dredging of about 5.1 million cubic yards over a two-year period. Additional annual maintenance dredging would result in about 50,000 cubic yards. Implementation of navigation improvements for Richmond Harbor channels would result in initial dredging of 7.2 million cubic yards over about two years, and increased annual maintenance dredging requirements by 300,000 cubic yards. The Navy is planning on deepening some of their berthing areas at the Alameda Naval Air Station in FY 86. Approximately 750,000 cubic yards of this material is planned to be disposed at the Alcatraz site. Although the increase in the amount of material to be disposed at Alcatraz is two to three times the existing level, the Bay system is capable of assimilating these quantities. The material remaining in the Bay system would be recirculated and redistributed. As described previously, the annual inflow of sediments results in circulation and distribution throughout the Bay system. It should be noted that he disposal activity does not add sediments to the system, but redistributes them and results in the movement of sediment to the ocean. A forecasted schedule of new work and maintenance dredging with disposal at Alcatraz including John F. Baldwin Phase II is shown in Table 404-2.

Accumulation of material at the Alcatraz site is not expected with the increased amount of dredged material to be disposed, provided the consolidated material is broken up during dredging. Contaminant concentrations after disposal of dredged material are expected to remain at ambient levels or be rapidly diluted to ambient levels. This observation is based on elutriate test results and the mixing zone at the Alcatraz site.

h. Determination of Secondary Effects on the Aquatic Ecosystem.

The proposed project would eliminate the need for lightering petroleum tankers before they enter the harbor area. The channel would have sufficent width to allow two way passage of the largest ships presently calling at the

Richmond Long Wharf. The proposed project would reduce the risk of accidental petroleum spills from lightering or ship collisions or grounding.

All benthic fuana inhabiting the dredged sediments will be removed, leaving the channels in a temporary state of depressed biological productivity. The impact of this dredging on benthos in the work area will be more significant if the West Richmond Channel is dredged, because this area has not been dredged previously. Although natural recovery will eventually repopulate the dredged channels, a slight depression in biological productivity will continue to exist compared to natural levels as the sites will be disturbed by subsequent maintenance dredging operations.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge.

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. Two other alternative in-bay aquatic disposal sites could be used for aquatic disposal of the dredged material: SF 10 in San Pablo Bay and SF-9 in Carquinez Strait. Each of these sites is further from the Golden Gate than the proposed disposal site south of Alcatraz Island, SF-11, soi a smaller portíon of the disposed material would exit the Bay via the Gate. The two alternative sites are also further from the dredging site so would increase transportation costs. Land disposal and ocean disposal of the material were also considered and discussed under Section 2.10 of the EIS. Both of these alternatives are considered infeasible at this time. Beach disposal of the sandy material is not practicable because no area of the dredging project is made up exclusively of sands. Separation of the sand from the fine material would increase both construction time and cost.

c. The proposed disposal of dredged material at the Alcatraz disposal site would not violate any applicable State or Federal Water quality criteria. The discharge would not violate the toxic effluent standards of Section 301 of the Clean Water Act.

d. Use of the disposal site would nto harm any endangered species or their critical habitat.

e. The project would not impact upon any Marine Sanctuaries designated by the Marine Protection, Research and Sanctuaries Act.

f. The proposed disposal of dredged material would not result in significant adverse impacts oin human health and welfare including municipal and private water supplies, recreation and commercial fishing, plankton, fish, aquatic ecosystem diversity; productivity and stability and recreational aesthetic and economic values would not occur.

g. To minimize the potential adverse impact of the discharge on the aquatic system the disposal site has been chosen to maximize the amount of material which would exit the bay via the Golden Gate.

h. On the basis of the guidelines the proposed disposal site for the discharge of dredged material is specified as complying with the requirements of these guidelines.

TABLE 1
ELUTRIATE RESULTS

Sample Location	Sample	Oil- Grease	Hydro Carbons	Mercury	Lead	Zinc	Cadmium	Copper	PCB'S (ug/l)	TICH (ug/l)
				Contaminant (mg/l)						
West Richmond Channel	A	1-	0.2-	.0001	.006-	.010	0.0010	0.003	-	-
	A	1-	0.2	.0002	.006-	.010	0.0016	0.003	0.035	0.001
	A	1-	0.2	.0009	.006-	.010	0.0013	0.002	0.022	0.001
	D	1-	0.2	.0002	.006-	.010	0.0075	0.002	0.024	0.001
Southampton Shoal Channel	Y	1-	0.2	.0001	.006-	.010	0.003	0.0030	.025	0.001
Richmond		1	0.3-	.0001-	.005-	.001-	.0005-	.005	.05-	.001-
Longwharf	(J-T)	2	0.3-	.0003	.005-	.001-	.0005-	.001-	.05-	.001-
		2	0.3-	.0001-	.005-	.001-	.0005-	.002	.05-	.001-
		1	0.3-	.0001-	.005-	.001-	.0005-	.004	.05-	.001-
		2	0.3-	.0002	.005-	.001-	.0005-	.002	.05-	.001-
	M-1	1	0.3-	.0003	.005-	.001-	.0005-	.004	.05-	.001-
	M-1	1	0.3-	.0001-	.005-	.002	.0005-	.003	.05-	.001-
	M-1	2	0.3-	.0001-	.005-	.001-	.0005-	.004	.05-	.001-
	N-1	1	0.3-	.0002	.005-	.004	.0005-	.003	.05-	.001-
	N-2	1	0.3-	.0001	.005-	.001-	.0005-	.004	.05-	.001-
	N-3	2	0.3-	.0001	.005	.001-	.0005-	.003	.05-	.001-
	N-4	3	0.3	.0001-	.005-	.001	.0005-	.004	.05-	.001-
	A'	1-	0.2	.0002-	.02	.02	.0002	.009	.0005-	.0005-
	B'	1.5	0.2-	.0002-	.02	.006	.002	.007	.0005-	.0005-
	C'	1	0.2-	.0002-	.03	.002	.003	.007	.0005-	.0005-
	D'	1-	0.2-	.0002-	.03	.004	.003	.008	.0005-	.0005-
	E'	1	0.2-	.0002-	.04	.005	.004	.007	.0005-	.0005-
	F'	1-	0.2-	.0002-	.04	.008	.003	.008	.0005-	.0005-
	G'	1-	0.2-	.0002-	.03	.01	.003	.007	.0005-	.0005-
Disposal Site Water Chemistry	1WC	1	0.3-	.0001-	.005-	.043	.001	.003	.05-	.001-
	2WC	1	0.3-	.0001	.005-	.042	.001	.004	.05-	.001-
	3WC	3	0.3-	.0001-	.005-	.042	.001	.004	.05-	.001-
	4WC	3	0.3-	.0001-	.005-	.044	.001	.003	.05-	.001-
	5WC	2	0.3-	.003	.005-	.046	.001	.003	.05-	.001-
State Objective (1978)		75	-	0.0014	.08	.02	.03	.05	6.0 ug/l	

"Ocean Plan for California" (instantaneous maximum)

EPA criteria	-		-	0.0037	0.668	0.170	0.059	0.023	0.01	-

Federal Register 28 November 1980 (instantaneous maximum)

TABLE 404-2
Alcatraz Disposal Quantities
Million Cubic Yards

Projects/FY	84	85	86	87	88	89	90	91	92	93	94	95	96
Maintenance*	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Permits	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
JFB II		3.00	3.00	3.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Oakland Outer			0.25	2.38	2.22	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Richmond					3.00	3.11	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Oakland Inner					2.50	2.50	0.15	0.05	0.05	0.05	0.05	0.05	0.05
JFB III						2.00	2.00	2.13	2.25	2.38	2.50	0.63	0.63
Alameda, NAS			0.75										
TOTAL	4.50	7.50	8.50	9.88	12.27	12.25	6.93	6.96	7.08	7.21	7.33	5.46	5.46

*Maintenance Dredging to current project depths.

Calculation of Concentration of Suspended Particulate Phase
at the Alcatraz Disposal Site from a Barge
(Values are from DDS Appendix N)

Note: The predicated disposal volume was calculated from figures for barge disposal since this situation represents the worst case analysis.

Particle size	Mixing volume
clay	8.42×10^4 m^3
silt	1.84×10^6 m^3
sand	7.19×10^4 m^3

Mixing volumes for each core sample (Vm)

Sample A'1-4

33% clay x 8.42×10^4 m^3 = 2.78×10^4 m^3
46% silt x 1.84×10^6 m^3 = 8.46×10^5 m^3
21% sand x 7.19×10^4 m^3 = 1.51 x 104 m3
8.89×10^5 m^3 = Vm

Sample C'1-6

36% clay x 8.42×10^4 m^3 = 3.03×10^4 m^3
51% silt x 1.84×10^6 m^3 = 9.38×10^5 m^3
13% sand x 7.19×10^4 m^3 = 9.35 x 103 m3
9.78×10^5 m^3 = Vm

Sample F'1-5

18% clay x 8.42×10^4 m^3 = 1.52×10^4 m^3
22% silt x 1.84×10^5 m^3 = 4.05×10^5 m^3
60% sand x 7.19×10^4 m^3 = 4.31 x 104m3
4.63×10^5 m^3 = Vm

Volume of discharge vessel (V_T) = 5500m^3
Volume of liquid phase in the discharge (Vw) = 3900 m^3
Volume of suspended particulate (Vsp)

$$Vsp = (V_t - Vw)\ \frac{(Pc + Ps)}{100}$$

where: Pc = percentage clay
Ps = percentage silt

for sample A'1-4

$$Vsp = (5500\ m^3 - 3900\ m^3) \times \frac{33+46}{100}$$

$$Vsp = 1264\ m^3$$

Mixing volumes for each core sample (Vm) (cont'd)

Sample C'1-6

$$Vsp = (5500\ m^3 - 3900\ m^3) \times \frac{36+51}{100}$$

$$Vsp = 1392\ m^3$$

Sample F'1-5

$$Vsp = (5500\ m^3 - 3900\ m^3) \times \frac{18+22}{100}$$

$$= 640\ m^3$$

Concentration of suspended particulate phase at the disposal site after initial mining (Csp)

For Sample A'1-4:

$$Csp = \frac{1264\ m^3}{8.89 \times 10^5\ m^3} \times 10^2 = 0.14\%$$

For Sample C'1-6:

$$Csp = \frac{1392\ m^3}{9.78 \times 10^5\ m^3} \times 10^2 = 0.14\%$$

For Sample F'1-5:

$$Csp = \frac{640\ m^3}{4.63 \times 10^5\ m^3} \times 10^2 = 0.14\%$$

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RICHMOND LONG WHARF
MANEUVERING AREA

ANALYSIS OF SEDIMENTS

March 1982

AUTHORIZATION

1. Results of tests reported herein were requested by DA Form 2544 No. E86-82-3017 dated 29 December 1981, from the San Francisco District.

PURPOSE

2. The purpose of this study was to determine the amount of specified pollutants in samples of bottom sediments and to determine the grain size distribution.

SAMPLES

3. Sediment samples in plastic tubes and water samples in cubitaners were received on 13 and 15 January 1982.

TEST METHODS

4. a. Elutriate. Cadmium, lead, copper, zinc, mercury, oil and grease, petroleum hydrocarbons, PCB and TICH were run according to "Ecological Evaluation of Proposed Discharge of Dredge Material into Ocean Waters," by EPA/Corps of Engineers. The elutriation was accomplished using compressed air.

b. Particle size, Engineer Manual, EM 1110-2-1906.

TEST RESULTS

5. " ca are presented as follows:

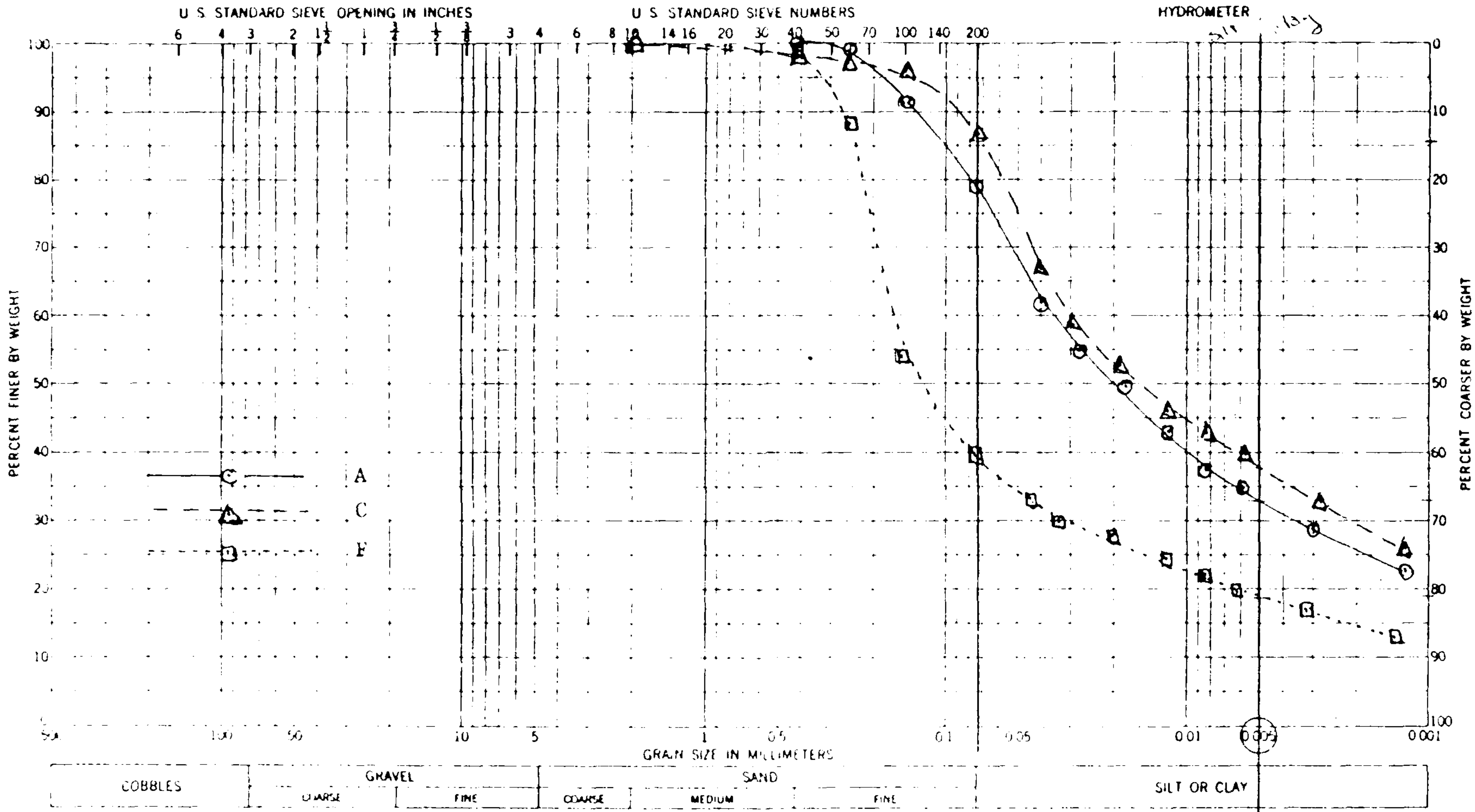
a. The table shows results of the elutriate analysis.

b. FNG Form 2087 shows he grain size distribution.

TABLE 1

LIQUID PHASE CHEMICAL ANALYSIS
OF
RICHMOND LONG WHARF MANEUVERING AREA

	Reported as Milligrams/Liter							Reported as Micrograms/Liter	
Field Sample No.	Oil & Grease	Residual Petroleum Hydrocarbons	Mercury (Hg)	Lead (Pb)	Zinc (Zn)	Cadmium (Cd)	Copper (Cu)	PCBs	Total Identifiable Chlorinated Hydrocarbons (TICH)
A′	1-	0.2	0.0002-	0.02	0.02	0.002	0.009	0.0005-	0.0005-
B′	1.5	0.2-	0.0002-	0.02	0.006	0.002	0.007	0.0005-	0.0005-
C′	1	0.2-	0.0002-	0.03	0.002	0.003	0.007	0.0005-	0.0005-
D′	1-	0.2-	0.0002-	0.03	0.004	0.003	0.008	0.0005-	0.0005-
E′	1-	0.2-	0.0002-	0.04	0.005	0.004	0.007	0.0005-	0.0005-
F′	1	0.2-	0.0002-	0.04	0.008	0.003	0.008	0.0005-	0.0005-
G′	1-	0.2-	0.0002-	0.03	0.01	0.003	0.007	0.0005-	0.0005-



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI

Project RICHMOND LONG WHARF
Maneuvering Area

Area

Boring No

Date March 1982

GRADATION CURVES

ENG FORM 1 MAY 63 2087

CHEMICAL TESTING

J. F. BALDWIN SHIP CHANNEL

ANALYSIS OF SEDIMENTS

JUNE 1981

AUTHORIZATION

1. Results of tests reported herein were requested by DA Form 2544, No. E86-81-3022, dated 13 May 1981, from the San Francisco District.

PURPOSE

2. The purpose of this study was to determine the amount of specified pollutants in samples of bottom sediments and to determine the grain size distribution.

SAMPLES

3. Sediment samples in plastic bags and water samples in plastic carboys were delivered on 7 May and 3 June 1981, by Marine Research Center.

TEST METHODS

4. a. Elutriate. Petroleum hydrocarbons, oil and grease, PCB, total identifiable chlorinated hydrocarbons, mercury, cadmium, lead, zinc, and copper were run according to "Ecological Evaluation of Proposed Discharge of Dredge Material into Ocean Waters," by EPA/Corps of Engineers. The elutriation was accomplished using compressed air.

b. Particle size, Engineer Manual EM 1110-2-1906.

TEST RESULTS

5. Data are presented as follows:

a. Table I shows the results of the elutriate analysis.

b. SPD Form 66M show the mechanical analysis.

TABLE I

LIQUID PHASE CHEMICAL ANALYSIS
OF
J. F. BALDWIN SHIP CHANNEL

	Reported as Milligrams/Liter							Reported as Micrograms/Liter	
Field Sample No.	Oil & Grease	Residual Petroleum Hydrocarbons	Mercury (Hg)	Lead (Pb)	Zinc (Zn)	Cadmium (Cd)	Copper (Cu)	PCPs	Total Identifiable Chlorinated Hydrocarbons (TICH)
A Grab (Slick)	1-	0.2-	0.0001	0.006-	0.010	0.0010	0.003	(a)	(a)
A Grab (Sand)	1-	0.2	0.0002	0.006-	0.010	0.0016	0.003	0.035	0.001-
A Core 38'-47'	1-	0.2-	0.0009	0.006-	0.010	0.0013	0.002	0.022	0.001-
D Core	1-	0.2	0.0002	0.006-	0.010	0.0075	0.002	0.024	0.001-
Y Grab	1-	0.2-	0.0001	0.006-	0.010	0.0005	0.003	0.025	0.001-

Note: The quantity of samples C Grab and F Grab was not enough to elutriate.

(a) Not enough sample for PCB and TICH.

U. S. ARMY ENGINEER DIVISION LABORATORY--SOUTH PACIFIC

SOIL TEST RESULT SUMMARY

PROJECT: J. F. BALDWIN SHIP CHANNEL

DATE May 1981

DIVISION SERIAL NO.	HOLE NO.	CO-ORD OR STA.	FIELD SAMPLE NO.	DEPTH OR ELEVATION FROM	DEPTH OR ELEVATION TO	MECHANICAL ANALYSIS-% FINER: GRAVEL		1/2	3/8	SAND: NO.4	NO.10	NO.40	NO.60	FINES: NO.200		SPECIFIC GRAVITY: +4	-4
810158	A Grab										100	96	89	55			2.71
810159	A Grab									100	99	95	79	46			2.74
810160	A Core			38'	47'						100	99	94	67			2.68
810161	B Grab							100	97	88	82	76	60	8			2.76
810162	C Grab									100	97	91	79	22			2.74
810163	D Grab							100	96	86	75	63	40	6			2.79
810164	D Core										100	97	74	30			2.74
810165	E Grab						100	97	85	72	62	51	31	8			2.78
810166	F Grab									100	97	93	75	36			2.77
810167	G Grab									100	96	84	39	3			2.75
810168	H Grab									100	95	27	11	4			2.73
810169	I Grab								100	99	96	57	17	2			2.73
810170	U Grab											100	95	7			2.75
810171	V Grab											100	96	2			2.75
810172	W Grab										100	94	42	3			2.74
810173	X Grab											100	84	10			2.76
810174	Y Grab										100	99	95	48			2.74

SPD FORM 1 SM

PLATE 1

U. S. ARMY ENGINEER DIVISION LABORATORY--SOUTH PACIFIC

SOIL TEST RESULT SUMMARY

PROJECT: J. F. BALDWIN SHIP CHANNEL DATE May 1981

DIVISION SERIAL NO.	HOLE NO.	COORD. OF STR.	FIELD SAMPLE NO.	DEPTH OR ELEVATION FROM	DEPTH OR ELEVATION TO	MECHANICAL ANALYSIS-% FINER GRAVEL				SAND NO.4	SAND NO.10	SAND NO.40	SAND NO.60	FINES NO.200		SPECIFIC GRAVITY +4	SPECIFIC GRAVITY -4
810175	Z Grab										100	96	59	5			2.74
810176	AA Grab										100	99	73	3			2.75
810177	AB Grab											100	94	8			2.73
810178	AC Grab											100	93	12			2.75

SPD FORM 65M PLATE 2

TECHNICAL EVALUATION OF BIOACCUMULATION POTENTIAL OF PROPOSED DREDGING OPERATION FROM THE RICHMOND LONG WHARF PORTION OF THE JOHN F. BALDWIN SHIP CHANNEL

Final Report

Prepared For:

U.S. Army Corps of Engineers

San Francisco District
211 Main Street
San Francisco, California

Prepared By:

Marine Bioassay Laboratories
1234 Highway One
Watsonville, California

13 August 1982

ABSTRACT

The San Francisco District, Corps of Engineers, in accordance with Section 404 Evaluation Guidelines, has required bioaccumulation studies as part of the evaluation of proposed dredging of the John F. Baldwin Ship Channel, near Richmond, California. Bioaccumulation potential was assessed by Marine Bioassay Laboratories of Watsonville, California using modified laboratory and data interpretive techniques.

The test species was specified by the San Francisco District Army Corps of Engineers to be *Tapes japonica* (Japanese littleneck clam). Samples of dredge material were collected by Army Corps personnel and delivered to MBL's Davenport Facility for testing. Statistical analysis of bioaccumulation results revealed no significant uptake of: Cadmium, Copper, Lead, Mercury, Zinc, Total Chlorinated Hydrocarbons plus Polychlorobiphenyls (PCB's) or Petroleum Hydrocarbons.

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Section I. INTRODUCTION

A. Background

Dredging activites for Phase II of the John F. Baldwin Ship Channel may cause increased suspended solids loads in the water column. The California Regional Water Quality Control Board has expressed concern that sediments from the Richmond Long Wharf portion of the project may impact upon public clam-fishing grounds in the nearby Albany/Richmond areas and that the clams may bioconcentrate metals and/or organic compounds. In response to this concern, the San Francisco District, Army Corps of Engineers, has requested an assessment of the potential for bioaccumulation by clams of metals and organics from samples of materials to be dredged from the Baldwin Ship Channel (Contract DACW07-06-C-0002 81 Jun 01, Work Order #0005).

B. Study Objective and Scope

The study objective was to perform bioaccumulation testing on dredge materials.

The study scope is limited to implementation of specified testing methodology for determination of bioaccumulation potential.

C. Experimental Design

The objective of the study is to determine whether resuspended sediments from dredging activities in the Baldwin Ship Channel will contribute to bioaccumulation of any of several constituents by clams in public fishing grounds in the nearby Albany/Richmond Area. The experi-

ment was designed to simulate, the appropriate controls, the projected field situation. The experimental components are defined as follows:

(1) Control Sediment - Relatively unpolluted natural sediment collected from an offshore site near Moss Landing (Monterey, California).[1]

(2) Reference Sediment - Sediment collected by MBL personnel from the public clamming grounds in Albany/Richmond Area (Figure 1).

(3) Dredge Material - Sediment collected by San Francisco Army Corps of Engineers personnel from the Richmond Long Wharf portion of the John F. Baldwin Ship Channel.

(4) Experimental Animals - Japanese littleneck clams (Tapes japonica) collected from Washington State and purchased by MBL personnel from a local seafood distributor.

(5) Davenport Water - Seawater pumped through a 12-inch PVC intake line from 130 meters seaward of the beach at Davenport Landing, California.

In the Experimental Treatment, clams were acclimated for 10 days in Reference Sediment, placed in the bioaccumulation tanks in a tray with Reference Sediment, and exposed to a suspension of Dredge Material. The Reference Treatment represented a control for the suspension of dredge material and consisted of clams acclimated for 10 days to Reference Sediment, placed in the bioaccumulation tanks in a tray with Reference Sediment and exposed to suspended Reference Sediment. The Control Treatment consisted of clams placed in the bioaccumulation tanks in a tray with Control Sediment and exposed only to ambient seawater.

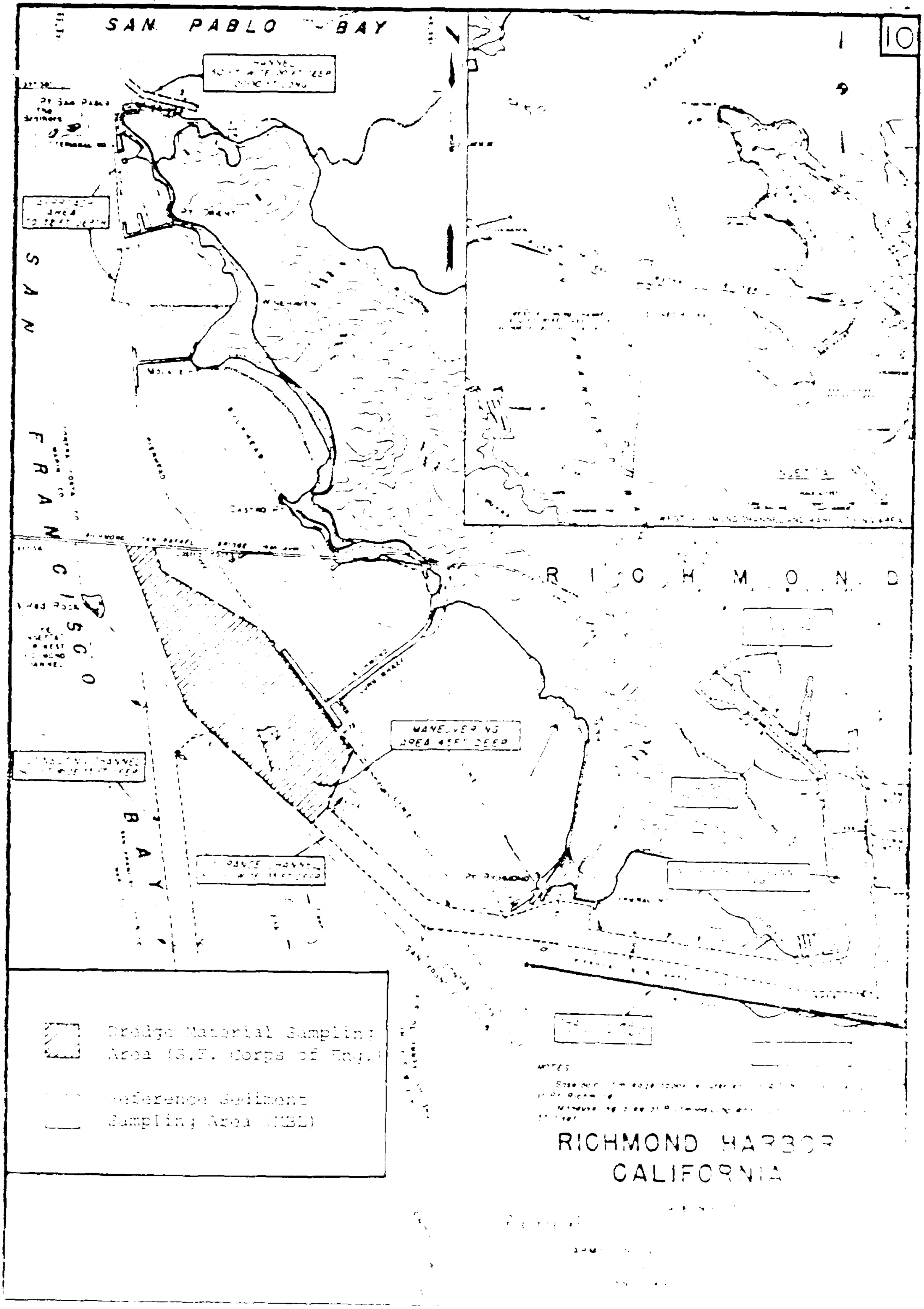

Figure 1. Sample locations [illegible]

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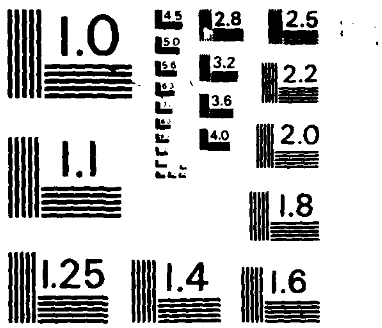

1.0
4.5
5.0
5.6
6.3
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

Section II. MATERIALS AND METHODS

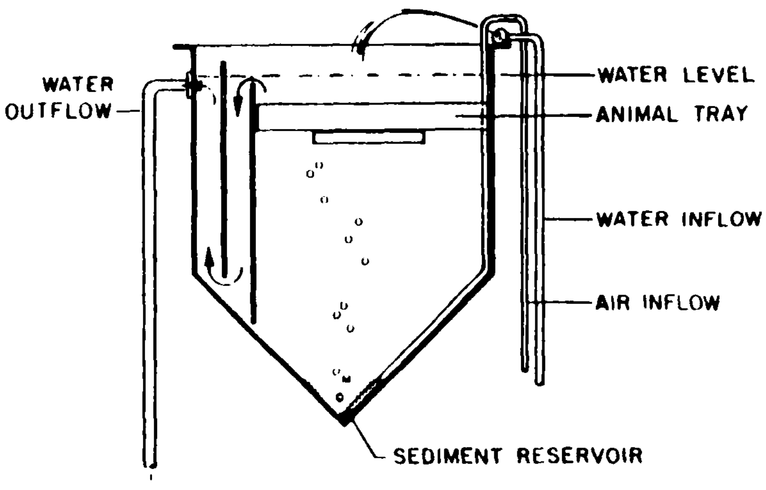
A. Experimental Animals

The species specified by the San Francisco District Army Corps of Engineers to be used in the bioaccumulation assessment was *Tapes japonica* the Japanese littleneck clam. Experimental animals were purchased from Joe Pucci & Sons, a commercial seafood wholesaler in Oakland, California.

B. Experimental Setup

The relatively long duration of the experiment requires that several conditions be facilitated by the physical setup. These include relatively constant temperature, continuous flow of seawater, aeration and mild sediment suspension. The setup developed for this test, by its simplicity, ensured that these conditions would be maintained.

A single "V" bottomed fiberglass tank measuring 4' x 8' x 5' high was internally partitioned into 4 equal segments. Each 2' x 4' x 5' deep segment was provided with a PVC aeration wand extending to and along the bottom of the "V", a constant inflow of seawater, and a series of baffles leading to an overflow drain (Figure 2). The control tank segment contained only Davenport Seawater. In each of the other tank segments, ten gallons of sediment were placed in the bottom before Davenport Seawater was introduced into the tank. Gentle aeration was provided which ensured both a constant high level of dissolved oxygen and maintenance of a mild sediment suspension throughout the water column. Excessive loss of suspended sediment via the overflow drain was avoided by routing the outgoing water through



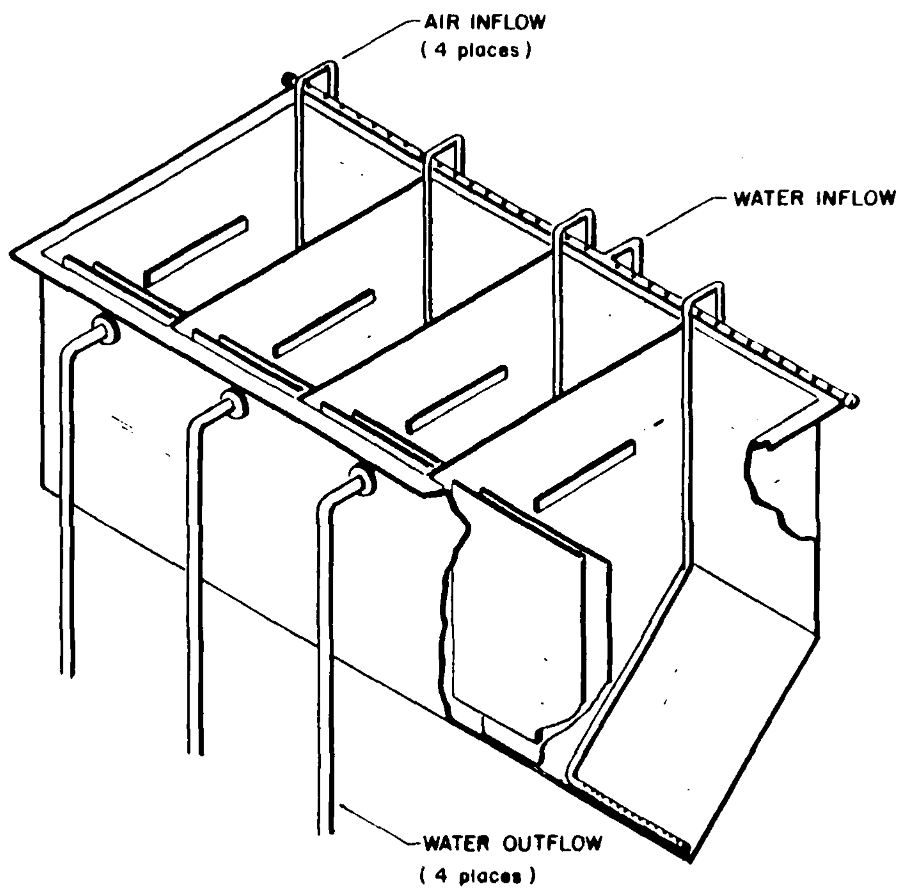


Figure 2. Bioaccumulation Tank Systems

the baffle system (Figure 2), wherein the slow net water flow and quiet water conditions facilitated settlement of suspended sediment and its return to the bottom sediment reservoir. Ambient seawater temperature at Davenport remained at 15 °C ± 2 °C throughout the experiment. Flow into each experimental tank segment was maintained at about 1 liter per minute; providing a water turnover rate of about 2.5 tank volumes each 24 hours.

Experimental animals were placed in trays filled with "Reference" or "Control" sediment, and trays were held at a depth of 10" (25 cm) below the water surface in each experimental subunit (Figure 1).

No effort was made to feed the clams during the 10-day uptake phase nor the 10-day depuration phase of the experiment on the assumption that indigeneous phytoplankton passing through the sand filter would provide adequate nutrition. Survival of experimental animals was greater than 98% over the course of the experiment.

C. Experimental Procedures

Ten gallons of dredge material were placed in the bottom of the "Experimental" tank segment and 135 similarly-sized (7 to 9 cm) and acclimated *Tapes japonica* were placed in a tray containing Reference sediment. Ten gallons of Reference sediment were placed in the bottom of the "Reference" tank segment and 45 clams added to a Reference-sediment-filled tray. A third tank segment contained no sediment in the bottom, and 45 clams were placed in a tray filled with "Control" sediment. Water flow was initiated and aeration adjusted to produce a mild sediment suspension in Experimental and Reference tank segments.

Fifteen clams were removed from the Experimental tank after 0, 30, 60, 120 and 240 hours of exposure to suspended sediment. Upon completion of the

240-hour (10-day) uptake phase of the experiment, the remaining clams were transferred to a tray containing control sediment and placed into a tank segment containing no sediment in the bottom. Additional 15-clam samples were taken after 30, 60, 120 and 240 hours of exposure to clean water.

Since Reference and Control situations were designed as checks on possible bioaccumulation resulting from non-treatment variables in the experimental situation, tissue samples were collected only initially, after 240 hours of uptake and again after 240 hours of depuration.

After the 240-hour (10-day) uptake period, Reference clams were transferred to a tray filled with Control sediment-clean water situation for the remaining 10-days (depuration phase) of the experiment.

Each 15-clam sample was randomly divided into 3 groups of 5 clams each. After opening and rinsing, muscle tissue from foot, adductors and siphons was dissected. Muscle from each 5-clam subsample was composited and homogenized to provide tissue for analyzing copper, cadmium, zinc, lead, mercury, total chlorinated hydrocarbons plus polychlorobiphenyls (PCB's) and petroleum hydrocarbons. Each 15-clam sample, provided tissue enough for three replicate analyses of the above constituents.

Metal analyses were performed by Atomic Absorption Spectophotometry using an IL151 and IL555 graphite furnace. Total chlorinated hydrocarbons plus PCB's and petroleum hydrocarbon analyses were done by gas chromatography using a Hewlett Packard gas chromatograph, Model 5730.

D. Data Analysis and Interpretation

Data analysis and interpretive procedures are illustrated in Figure 3. To determine accumulation in tissue from exposure to dredge material, the data from the uptake phase of the Experimental, Reference and Control samples were subjected to homogeneity tests, multisample analyses (Analysis of Variance or Kruskal-Wallis) and multiple comparison (Dunnett's or Wilcoxon-Wilcox) using 0 hours as comparative datum. Significance was determined at alpha = 0.05. When accumulation, of a given constituent, did not occur, the biomagnification potential of the proposed operation was considered unlikely. When accumulation does occur, biomagnification potential must be more carefully examined.

Biomagnification potential, when significant uptake occurred, was evaluated by comparing the uptake rate constant (K_1) to the depuration rate constant (K_2). These constants are calculated by regression analysis[2] and a modification of the ASTM bioconcentration method[3] for toxic organic compounds.

The uptake rate constant is calculated as follows:

$$K_1 = \frac{\Sigma\, dCa/dt + K_2 Ca}{n_t}$$

where: dCa/dt = tangent to regression line at given time (t)

K_2 = slope of the regression line best fit to depuration

Ca = tissue concentration

n_t = number of sampling times

When the uptake rate constant is greater than the depuration rate constant, clearly a potential for biomagnification of that contaminant is greater than for a contaminant with more similar uptake and depuration rate constants

($K_1 \leq K_2$). The conservative estimate for biomagnification potential would be where $K_1/K_2 \geq 10$ based upon the conventional trophic biomass conversion factor of 0.10.[4]

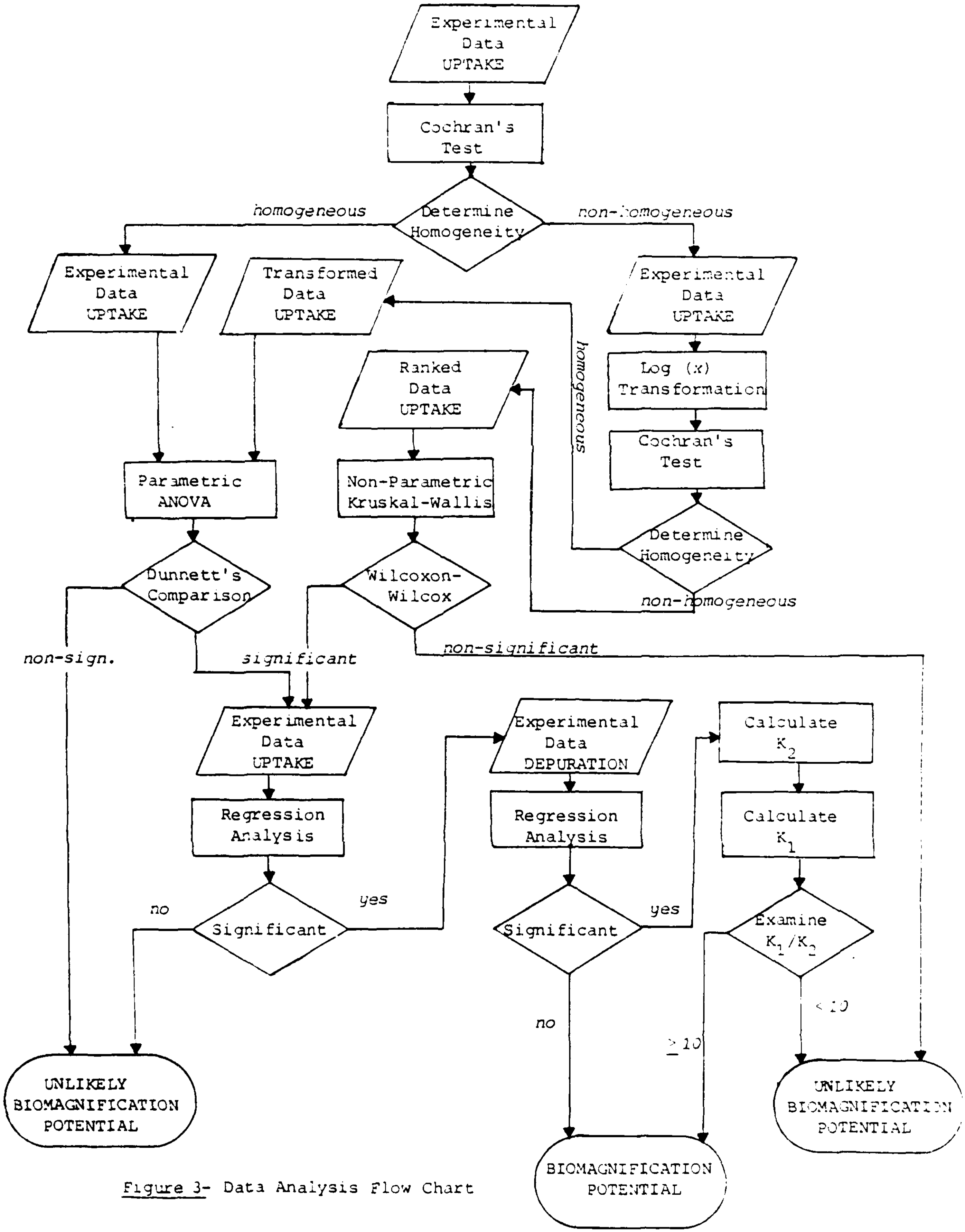


Figure 3- Data Analysis Flow Chart

Section III. RESULTS AND DISCUSSION

Muscle tissue of *Tapes japonica* was subjected to 240 hours exposure (10-days) to dredge material from the Richmond Long Wharf portion of the John F. Baldwin Ship Channel and was chemically analyzed for cadmium, copper, lead, mercury, zinc, total chlorinated hydrocarbons plus polychlorobiphenyls (PCB's) and petroleum hydrocarbons. These results are briefly summarized in Table 1 which lists sample means and variances.

All of the data were subjected to Cochran's test for homogeneity in preparation for statistical treatment. All data were homogeneous (Table 2). The data were then subjected to Analysis of Variance and Dunnett's test (Appendix Tables A-8 to A-13), both parametric tests. The Dunnett's test compared each of the sample means to the time zero reference treatment. The results of the Dunnett's test were not significant for any of the constituents. This analysis indicates that *Tapes japonica* muscle tissues did not accumulate any of the constituents tested for during the 240-hour exposure. Since uptake of these constituents did not occur, regression analyses to determine uptake and depuration rate constants (K_1 and K_2) were not necessary (Figure 3). It is concluded that biomagnification potential of the tested constituents: cadmium, copper, lead, mercury, zinc, total chlorinated hydrocarbons plus PCB's and petroleum hydrocarbons is unlikely to result from the dredging activities of the Richmond Long Wharf portion of Phase II of the John F. Baldwin Ship Channel.

TABLE 1. TISSUE CHEMISTRY SUMMARY ON TAPES JAPONICA MUSCLE TISSUE

CONSTITUENT		Tissue Concentration (n=3)						
		Sample Time (hours)						
		0	30	60	120	240	240 Ref	240 Con
Cadmium	$\bar{x}$	0.330	0.357	0.250	0.350	0.310	0.410	0.367
	s^2	0.0007	0.0014	0.0001	0.0012	0.0004	0.0039	0.0005
Copper	$\bar{x}$	0.843	0.993	0.683	0.810	0.943	0.767	0.673
	s^2	0.0025	0.0401	0.0081	0.0097	0.0024	0.0169	0.0049
Lead	$\bar{x}$	5.57	3.43	3.50	4.23	3.80	3.80	3.80
	s^2	3.57	0.69	0.07	0.08	0.07	0.13	0.0
Mercury	$\bar{x}$	0.273	0.303	0.273	0.300	0.283	0.313	0.277
	s^2	0.0002	0.0004	0.0002	0.0021	0.0006	0.0006	0.00003
Zinc	$\bar{x}$	6.17	5.30	6.67	6.10	6.50	7.03	6.07
	s^2	0.50	0.04	2.12	0.13	0.43	0.56	0.26
Total Chlorinated Hydrocarbons + PCB's	$\bar{x}$, s^2	None Detected in any sample (< 0.01 mg/kg)						
Petroleum Hydrocarbons	$\bar{x}$, s^2	None Detected in any sample (< 0.01 mg/kg)						

TABLE 2. SUMMARY OF STATISTICAL ANALYSES

CONSTITUENT	Cochran's Test (C-value)	Analysis of Variance (F-value)	Significant Accumulation (Dunnett's)
Cadmium	0.4756 ns	6.39*	none
Copper	0.4740 ns	3.63*	none
Lead	0.7744 ns	2.42 ns	none
Mercury	0.5085 ns	1.30 ns	none
Zinc	0.5248 ns	1.57 ns	none
Total Chlorinated Hydrocarbons & PCB's	-	-	none
Petroleum Hydrocarbons	-	-	none

ns indicates non-significant result (alpha = 0.05)
* indicates significant result (alpha = 0.05)

REFERENCES

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A P P E N D I X

CONTENTS OF APPENDIX

TABLE A-1 BALDWIN SHIP CHANNEL BIOACCUMULATION

Tapes japonica

Tissue Chemistry - Cadmium

Treatment	Cadmium Tissue Concentration (mg/kg)						
	Elapsed Time (hours) 0	30	60	120	240	Reference 240	Control 240
UPTAKE PHASE	0.31	0.33	0.26	0.33	0.31	0.39	0.34
	0.32	0.40	0.24	0.39	0.33	0.48	0.38
	0.36	0.34	0.25	0.33	0.29	0.36	0.38
$\bar{x}$	0.330	0.357	0.250	0.350	0.310	0.410	0.367
s^2	0.0007	0.0014	0.0001	0.0012	0.0004	0.0039	0.0005
DEPURATION PHASE	0.31	0.35	0.37	0.37	0.35	0.37	0.36
	0.33	0.36	0.44	0.36	0.39	0.43	0.41
	0.29	0.35	0.36	0.33	0.36	0.46	0.46
$\bar{x}$	0.310	0.353	0.390	0.353	0.367	0.420	0.410
s^2	0.0004	0.00003	0.0019	0.0004	0.0004	0.0021	0.0025

TABLE A-2 BALDWIN SHIP CHANNEL BIOACCUMULATION

Tapes japonica

Tissue Chemistry - Copper

Treatment		Tissue Concentration (mg/kg)						
		Elapsed Time (hours)					Reference	Control
		0	30	60	120	240	240	240
UPTAKE PHASE		0.85	0.80	0.77	0.73	0.92	0.68	0.74
		0.89	0.98	0.69	0.92	1.00	0.92	0.68
		0.79	1.20	0.59	0.78	0.91	0.70	0.60
	$\bar{x}$	0.843	0.993	0.683	0.810	0.943	0.767	0.673
	s^2	0.0025	0.0401	0.0081	0.0097	0.0024	0.0169	0.0049
DEPURATION PHASE		0.92	0.86	0.63	0.63	0.71	0.66	0.74
		1.00	0.71	0.77	0.63	0.70	0.95	0.74
		0.91	0.75	0.60	0.63	0.64	1.00	0.64
	$\bar{x}$	0.943	0.773	0.667	0.630	0.683	0.870	0.707
	s^2	0.0024	0.0060	0.0082	0.0	0.0014	0.0337	0.0033

TABLE A-3 BALDWIN SHIP CHANNEL BIOACCUMULATION

Tapes japonica

Tissue Chemistry - Lead

Treatment		Lead Tissue Concentration (mg/kg)						
		Elapsed Time (hours)					Reference	Control
		0	30	60	120	240	240	240
UPTAKE PHASE		7.7	2.5	3.6	3.9	3.6	3.4	3.8
		4.9	4.1	3.7	4.4	4.1	4.1	3.8
		4.1	3.7	3.2	4.4	3.7	3.9	3.8
	$\bar{x}$	5.57	3.43	3.50	4.23	3.80	3.80	3.80
	s^2	3.57	0.69	0.07	0.08	0.07	0.13	0.0
DEPURATION PHASE		3.6	2.8	4.2	3.8	3.5	3.4	3.1
		4.1	3.6	4.7	3.9	3.3	4.0	3.9
		3.7	3.7	4.5	3.4	2.9	3.8	3.3
	$\bar{x}$	3.80	3.37	4.47	3.70	3.17	3.73	3.43
	s^2	0.07	0.24	0.06	0.07	0.17	0.09	0.17

TABLE A-4

BALDWIN SHIP CAHNNEL BIOACCUMULATION

Tapes japonica

Tissue Chemistry - Mercury

Treatment		Mercury Tissue Concentration (mg/kg)						
		Elapsed Time (hours) 0	30	60	120	240	Reference 240	Control 240
UPTAKE PHASE		0.26	0.32	0.29	0.31	0.31	0.29	0.28
		0.27	0.28	0.27	0.25	0.26	0.31	0.27
		0.29	0.31	0.26	0.34	0.28	0.34	0.28
	$\bar{x}$	0.273	0.303	0.273	0.300	0.283	0.313	0.277
	s^2	0.0002	0.0004	0.0002	0.0021	0.0006	0.0006	0.00003
DEPURATION PHASE		0.31	0.31	0.32	0.24	0.26	0.32	0.27
		0.26	0.26	0.28	0.27	0.27	0.34	0.29
		0.28	0.37	0.24	0.26	0.28	0.26	0.31
	$\bar{x}$	0.283	0.313	0.280	0.257	0.270	0.307	0.290
	s^2	0.0006	0.0030	0.0016	0.0002	0.0001	0.0017	0.0004

TABLE A-5 BALDWIN SHIP CHANNEL BIOACCUMULATION

Tapes japonica

Tissue Chemistry - Zinc

Treatment		Zinc Tissue Concentration (mg/kg)						
		Elapsed Time (hours)					Reference	Control
		0	30	60	120	240	240	240
UPTAKE PHASE		5.4	5.3	6.5	5.8	5.9	7.0	5.5
		6.8	5.1	8.2	6.5	7.2	7.8	6.2
		6.3	5.5	5.3	6.0	6.4	6.3	6.5
	$\bar{x}$	6.17	5.30	6.67	6.10	6.50	7.03	6.07
	s^2	0.50	0.04	2.12	0.13	0.43	0.56	0.26
DEPURATION PHASE		5.9	5.9	6.5	6.4	6.2	6.4	6.6
		7.2	6.9	7.8	6.6	6.9	7.3	6.1
		6.4	6.4	6.1	5.3	6.6	7.3	7.0
	$\bar{x}$	6.50	6.40	6.80	6.10	6.57	7.00	6.57
	s^2	0.43	0.25	0.79	0.49	0.12	0.52	0.20

TABLE A-6 BALDWIN SHIP CHANNEL BIOACCUMULATION

Tapes japonica

Tissue Chemistry TICH & PCB's

Treatment	TICH Tissue Concentration (mg/kg)						
	Elapsed Time (hours) 0	30	60	120	240	Reference 240	Control 240
UPTAKE PHASE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
$\bar{x}$							
s^2							
DEPURATION PHASE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	< 0.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
$\bar{x}$							
s^2							

TABLE A-7 BALDWIN SHIP CHANNEL BIOACCUMULATION

Tapes japonica

Tissue Chemistry PHC's

Treatment	PHC's Tissue Concentration (mg/kg)						
	Elapsed Time (hours) 0	30	60	120	240	Reference 240	Control 240
UPTAKE PHASE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
$\bar{x}$							
s^2							
DEPURATION PHASE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
$\bar{x}$							
s^2							

TABLE A-8 BALDWIN SHIP CHANNEL BIOACCUMULATION

Analysis of Variance - Uptake Phase

Tissue Chemistry - Tapes japonica

Dredge Material Stations	Analysis of Variance				
	Source	Degrees of Freedom	Sum of Squares	Mean Square	F-Value
Cadmium (mg/kg)	Total	20	0.062		
	Groups	6	0.045	0.0075	6.39*
	Error	14	0.016	0.0012	
	Critical Value = 2.85				
Copper (mg/kg)	Total	20	0.438		
	Groups	6	0.266	0.0444	3.63*
	Error	14	0.171	0.0122	
	Critical Value = 2.85				
Lead (mg/kg)	Total	20	18.832		
	Groups	6	9.592	1.599	2.42
	Error	14	9.240	0.660	
	Critical Value = 2.85				
Mercury (mg/kg)	Total	20	0.013		
	Groups	6	0.005	0.0008	1.30
	Error	14	0.009	0.0006	
	Critical Value = 2.85				
Zinc (mg/kg)	Total	20	13.550		
	Groups	6	5.443	0.9071	1.57
	Error	14	8.107	0.5790	
	Critical Value = 2.85				
Total Identifiable Chlorinated Hydrocarbons & Polychloro-biphenyls (PCB's)			None detected	(< 0.01 mg/kg)	
Petroleum Hydrocarbons			None detected	(< 0.1 mg/kg)	

* indicates significant result
alpha = 0.05

TABLE A-9 BIOACCUMULATION PHASE - <u>Tapes japonica</u>

Multiple Comparisons

Uptake Phase - Cadmium

Range From Comparative Datum (k)	Critical Value (q')	DUNNETT'S TEST Difference of Means *parametric*	WILCOXON-WILCOX Difference of Rank Sums *non-parametric*	Computed Value (q)
3	2.08	$\bar{x}_{30} - \bar{x}_0 = 0.027$		0.95
3	2.08	$\bar{x}_{60} - \bar{x}_0 = 0.080$		-2.83
2	1.76	$\bar{x}_{120} - \bar{x}_0 = 0.020$		0.71
2	1.76	$\bar{x}_{240} - \bar{x}_0 = 0.020$		-0.71
5	2.37	$\bar{x}_R - \bar{x}_0 = 0.080$		2.83*
4	2.25	$\bar{x}_C - \bar{x}_0 = 0.037$		1.31

TABLE A-10 BIOACCUMULATION PHASE - <u>Tapes japonica</u>

Multiple Comparisons

Uptake Phase - Copper

Range From Comparative Datum (k)	Critical Value (q')	DUNNETT'S TEST Difference of Means *parametric*	WILCOXON-WILCOX Difference of Rank Sums *non-parametric*	Computed Value (q)
3	2.08	$\bar{x}_{30} - \bar{x}_0 = 0.150$		1.66
4	2.25	$\bar{x}_{60} - \bar{x}_0 = 0.160$		-1.77
2	1.76	$\bar{x}_{120} - \bar{x}_0 = 0.033$		-0.37
2	1.76	$\bar{x}_{240} - \bar{x}_0 = 0.100$		1.11
3	2.08	$\bar{x}_R - \bar{x}_0 = 0.076$		-0.34
5	2.37	$\bar{x}_C - \bar{x}_0 = 0.170$		-1.88

t = transformed data used in calculations
- = not determined
* = significant result (alpha = 0.05)
r = Reference
c = Control

TABLE A-11 BIOACCUMULATION PHASE - <u>Tapes japonica</u>

Multiple Comparisons

Uptake Phase - Lead

Range From Comparative Datum (k)	Critical Value (q')	DUNNETT'S TEST Difference of Means *parametric*	WILCOXON-WILCOX Difference of Rank Sums *non-parametric*	Computed Value (z)
5	2.37	$\bar{x}_{30} - \bar{x}_0 = -2.14$		-3.33
4	2.25	$\bar{x}_{60} - \bar{x}_0 = -2.07$		-3.12
2	1.76	$\bar{x}_{120} - \bar{x}_0 = -1.34$		-2.02
3	2.08	$\bar{x}_{240} - \bar{x}_0 = -1.77$		-2.67
3	2.08	$\bar{x}_R - \bar{x}_0 = -1.77$		-2.67
3	2.08	$\bar{x}_c - \bar{x}_0 = -1.77$		-2.67

TABLE A-12 BIOACCUMULATION PHASE - <u>Tapes japonica</u>

Multiple Comparisons

Uptake Phase - Mercury

Range From Comparative Datum (k)	Critical Value (q')	DUNNETT'S TEST Difference of Means *parametric*	WILCOXON-WILCOX Difference of Rank Sums *non-parametric*	Computed Value (z)
5	2.37	$\bar{x}_{30} - \bar{x}_0 = 0.030$		1.50
0	-	$\bar{x}_{60} - \bar{x}_0 = 0.0$		-
4	2.25	$\bar{x}_{120} - \bar{x}_0 = 0.027$		1.35
3	2.08	$\bar{x}_{240} - \bar{x}_0 = 0.010$		0.50
6	2.46	$\bar{x}_R - \bar{x}_0 = 0.040$		2.00
2	1.76	$\bar{x}_c - \bar{x}_0 = 0.004$		0.20

t = transformed data used in calculations
- = not determined
* = significant result (alpha = 0.05)
r = Reference
c = Control

TABLE A-13 BIOACCUMULATION PHASE - Tapes japonica

Multiple Comparisons

Uptake Phase - Zinc

Range From Comparative Datum (k)	Critical Value (q')	DUNNETT'S TEST Difference of Means *parametric*	WILCOXON-WILCOX Difference of Rank Sums *non-parametric*	Computed Value (q)
4	2.25	$\bar{x}_{30} - \bar{x}_{0} = -0.87$		-1.40
3	2.08	$\bar{x}_{60} - \bar{x}_{0} = 0.50$		0.80
2	1.76	$\bar{x}_{120} - \bar{x}_{0} = -0.07$		-0.11
2	1.76	$\bar{x}_{240} - \bar{x}_{0} = 0.33$		0.53
4	2.25	$\bar{x}_{R} - \bar{x}_{0} = 0.86$		1.38
3	2.08	$\bar{x}_{c} - \bar{x}_{0} = -0.10$		-0.16

t = transformed data used in calculations
* = significant result (alpha = 0.05)
r = Reference
c = Control

APPENDIX C
FISH AND WILDLIFE SERVICE COORDINATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
U.S. Fish and Wildlife Service
2800 Cottage Way, Room E-2727
Sacramento, California 95825

November 17, 1982

District Engineer
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Sir:

This report supplements our detailed report of November 12, 1963, on the effects that deepening the San Francisco Bay to Stockton Navigation Project would have on fish and wildlife resources. Supplementation of the previous report is necessary because of modifications of the authorized construction plan that are now under consideration, and because of improved perceptions of project effects gained during the intervening time. This supplemental report, which deals only with Phase II of the John F. Baldwin segment of the San Francisco Bay to Stockton Navigation Project, was prepared under the authority, and in accordance with the provisions, of the Fish and Wildlife Cordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). This report is concurred in by the California Department of Fish and Game, as indicated in the attached copy of a letter from Director E.C. Fullerton, dated October 25, 1982. The report has been reviewed by the National Marine Fisheries Service.

Description of the Project

The San Francisco Bay to Stockton Navigation Project is comprised of two major segments: (1) the John F. Baldwin Ship Channel, extending from deep water in the Pacific Ocean to Pt. Edith near the community of Avon in lower Suisun Bay; and (2) the Stockton Ship Channel, extending from Pt. Edith to the City of Stockton. Deepening and widening of the existing navigation channel was authorized by the River and Harbor Act of 1965 (Public Law 89-298).

For planning and construction purposes, the John F. Baldwin Ship Channel is divided into three phases. Phase I applies to the deepening of the channel across San Francisco Bar in the Pacific Ocean to - 55 feet MLLW. Construction of Phase I work was completed in 1974. Phase II, the subject of this report, pertains to the excavation of West Richmond Channel (immediately south of Richmond-San Rafael Bridge) and the deepening of the Richmond Long Wharf Maneuvering Area to depths of 45 feet (Plate I). Under Phase III of John F. Baldwin Ship Channel construction, planning for which has been deferred pending resolution of technical problems, the channel would be deepened to 45 feet through Pinole Shoal in San Pablo Bay, upper Carquinez Strait, and lower Suisun Bay to Pt. Edith. Deepening of the Stockton Ship Channel (from Pt. Edith to Stockton) to -35 feet is in progress.

In lieu of West Richmond Channel construction, an element of the authorized plan for the San Francisco Bay to Stockton Navigation Project, the Corps of Engineers is evaluating the merits of deepening the Southampton Channel. The Southampton Channel is an existing navigation channel linking the Port of Richmond, as well as the Richmond Long Wharf Maneuvering Area, to deep water of San Francisco Bay. A further modification of the authorized plan under consideration by the Corps is disposal of dredged material in deep water near Alcatraz Island. Under the authorized plan, material dredged from West Richmond Channel and the Long Wharf area would be disposed of in shallow bay waters near Brooks Island.

Construction of the project according to the modified plan would involve clam shell or hopper dredge excavation of about 8.7 million cubic yards of material over a 3-year period, or a 6-year period if construction were curtailed during the winter months. Excavation would be to a depth of 47 feet to provide a 2-foot overdepth. The bottom width of the Southampton Channel would be 650 feet. Material dredged from The Southampton Channel and the Richmond Long Wharf Maneuvering Area would be disposed of in deep water 0.3 miles south of Alcatraz Island. Maintenance of the completed project would involve dredging about 100,000 cubic yards every 5 years with disposal south of Alcatraz.

Fish and Wildlife Resources

Fish

For anadromous fishes, the waters of the immediate project area, being generally deeper than 35 feet, function mainly as a segment of the migration corridor linking ocean and riverine habitats. All anadromous species associated with the rivers and streams of California's Central Valley must traverse the project area, or adjacent waters of Central San Francisco Bay, in their journeys to and from the sea. Among salmonid species, the chinook salmon and steelhead trout are the most important visitors to project area waters. Striped bass, American shad, and white sturgeon are other anadromous fishes for which project area waters afford a migration avenue. The shallow waters proximate to the shore and outside the area to be dredged are believed to provide rearing habitat for the young of some anadromous species. That this may be so is suggested by the results of otter trawl and beach seine sampling done by the Fish and Wildlife Service in 1974 in subtidal areas of San Pablo Bay near the City of Richmond (3). Young-of-the-year striped bass predominated among the various fishes captured in July, August, and September.

It is known that the intertidal zone and subtidal area (up to about 15 feet in depth) on the landward side of the Richmond Long Wharf are utilized by the Pacific herring for spawning (5). From December through March, gravid females cast their roe onto the substrate of these shallows and of other near-shore reaches of the Central Bay. The commercial fishery for herring that occurs in San Francisco Bay is directed more toward the harvest of roe than of the fish themselves, roe being prized as a gourmet food in Japan. Other piscine inhabitants of the near-shore zone, as well as the deeper water of the channel area, are northern anchovy, starry flounder, staghorn sculpin, shiner perch, surf smelt, jack smelt, threespine stickleback, northern midshipman, Japanese goby, ling cod, sablefish, Pacific hake,

cabezon, English sole, tiger shark, bat ray, spiny dogfish, Sacramento smelt, Pacific tomcod, white croaker, white surfpurch, brown rockfish, speckled sanddab, and California tonguefish.

Prominent among the benthic and bottom-dwelling invertebrates in and adjacent to the project area are amphipods, isopods, jellyfishes, horse mussel, basket cockle, Japanese cockle, soft-shelled clam, Franciscan bay shrimp, black-tailed bay shrimp, Oriental shrimp, hermit crab, slender crab, and Dungeness crab.

Most of the sport fishing that takes place in the vicinity of the project is for striped bass. An area favored by striper anglers is located off the northeast shore of Tiburon Peninsula, near the seaward end of the West Richmond Channel (2).

Wildlife

Wildlife utilization of the waters of the project area is limited to that made by certain avian species and by a sea mammal, the harbor seal.

Although San Francisco Bay provides habitat that is of critical importance to the maintenance of many of the species of migratory birds that comprise the Pacific Flyway population, most bird use is associated with intertidal areas and water no deeper than about 18 feet. The relatively deep water of the project area is utilized primarily by piscivorous birds such as grebes, cormorants, pelicans, gulls and terns, and by waterfowl such as canvasback, redhead, goldeneye, bufflehead, scaups, and scoters that make use of the expanse of open water for resting.

For many years, Castro Rocks, near the eastern end of the Richmond-San Rafael Bridge, has been used as a hauling-out site by a small population of harbor seals (2).

Little, if any, hunting for waterfowl occurs in the project area.

Discussion

Although shifting bottom sediments and a roiled and turbid water column are recurrent natural conditions to which organisms inhabiting San Francisco Bay are adapted, it may reasonably be presumed that an intensification of these conditions due to dredging and spoiling operations has a negative impact on the well-being of aquatic life. However, the results of studies addressing this question have not generally demonstrated that the impacts of channel excavation and disposal of uncontaminated dredged material in deep water are significantly adverse. It appears on the basis of empirical and experimental evidence gathered thus far that the adverse impacts are of a transitory nature and that repopulation of disturbed areas occurs rapidly. For new channels, however, the original diversity of species may not be regained (1,7).

In 1981, San Francisco Bay Marine Research Center, Inc., conducted a suspended particulate phase bioassay and a bioaccumulation test using bottom material from the Long Wharf Maneuvering Area and bay water from the Alcatraz disposal site

(4). Bottom materials from West Richmond Channel and Southampton Channel were not tested inasmuch as core and grab sampling revealed these bottom areas to be hard-packed sand. Of the three organisms bioassayed (English sole, grass shrimp, and a copepod), only English sole experienced sufficient mortality over the 96-hour test period to permit computation of LC50 values. Based on their observations during the bioassay, the researchers speculated that, because of the sole's bottom-dwelling habit, those fish that died may have succumbed to suffocation as suspended particulates settled to the bottoms of the 10-gallon aquariums in which they were held, rather than to any biologically active contaminants associated with the bottom material tested. Suffocation of English sole due to spoil deposition at the deep-water Alcatraz site, where fish are not confined, is not likely to occur. In any event, when the dilution of dredged material calculated to occur during initial mixing with bay water at Alcatraz was taken into account, it was concluded that the fish would not be exposed to concentrations of dredged material great enough to cause significant mortality due to any biologically active constituents. In its bioaccumulation test, Marine Research Center used Japanese cockle to measure the uptake of mercury, copper, zinc, lead, cadmium, chlorinated hydrocarbons, petroleum hydrocarbons, and polychlorinated biphenyls from Long Wharf Maneuvering Area sediments. Bioaccumulation over a 24-day test period was demonstrated for lead and copper, but not to levels judged to be significant with respect to established criteria.

In the years since deepening of the John F. Baldwin Ship Channel was authorized, concern has arisen that channel deepening would promote the incursion of sea water into the estuary and thereby raise salinity levels in Suisun Bay and the waterways of the Sacramento-San Joaquin Delta. To develop information bearing on this question, the Corps of Engineers performed a series of hydraulic tests at its San Francisco Bay-Delta Model facility, Sausalito, California, and Waterways Experiment Station, Vicksburg, Mississippi (6). On the basis of these tests it is believed that construction of Phase II of the John F. Baldwin Ship Channel project, as authorized, would not alter salinity distribution in Suisun Bay and the Delta in any significant way. The results of the testing program do indicate, however, that construction of Phase III (i.e., deepening Pinole Shoal Channel through San Pablo Bay; deepening Carquinez Strait Channel; and deepening Suisun Bay Channel from Martinez to Pt. Edith) would significantly alter salinity distribution in Suisun Bay and the Delta. Although the effects of deepening Southampton Channel (in lieu of West Richmond Channel) were not studied, it does not appear that this modification of the authorized Phase II plan would influence salinity distribution in the upper estuary in a way that would differ from the West Richmond Channel. The model studies indicate that salinity distribution in Suisun Bay and the Delta would not be affected unless the Carquinez Strait Channel were deepened.

The adverse effects of project construction on fish and wildlife resources could be substantially reduced in two ways by implementing the modified plan rather than the authorized plan for Phase II. In the first instance, the modified plan obviates the need to excavate the West Richmond Channel which, because of its natural depths in excess of 35 feet MLLW, has never been dredged. The Southampton Channel, on the other hand, was excavated to a depth of 37 feet MLLW years ago and has since been periodically dredged to maintain that depth. Moreover, the Southampton Channel will in all liklihood be deepend as part of the Corps of

Engineers plan to improve navigation channels serving Richmond Harbor. The Department of the Army is expected to seek Congressional authorization to deepen Southampton Channel, Richmond Harbor Entrance Channel, and Richmond Harbor Channel at an early date. Thus, selection of the modified plan for Phase II would essentially reduce by half the area of bay bottom that would otherwise be disrupted by channel deepening in the general project area. A reduction would also be realized in the total volume of dredged material to be disposed of from the two projects.

In the second instance, the modified plan provides for disposal of dredged material in deep waters of the Bay at Alcatraz Island rather than in shallow Bay waters in the vicinity of Brooks Island near Richmond Harbor. The shallow waters near Brooks Island are biologically important in that they afford habitat for bottom-dwelling mollusks, annelids, and arthropods as well as small nektonic creatures, all of which contribute to the sustenance of higher forms of life such as fishes, marine birds, and waterfowl. The shallow water areas of the Bay are crucially important nursery grounds for the young of various fishes including starry flounder, shiner surfperch, top smelt, northern anchovy, herring, and striped bass. While the deep water at Alcatraz is by no means devoid of aquatic life, it is less important than the shallow water areas of the Bay on a relative ecological basis.

Disposal of dredged material at the Alcatraz site would offer an additional advantage over the authorized disposal plan if release of the material into the water column is done only on the ebb flow of the tide. Releasing dredged material during the outgoing tide would maximize the transport of sediment from the estuary to the sea.

Recommendations

To minimize the adverse effects of project construction on fish and wildlife resources, the Fish and Wildlife Service recommends that:

1. Construction be done in accordance with the modified plan, which provides for deepening of the Southampton Channel and disposal of dredged material in deep water near Alcatraz Island;

2. Deposition of dredged material at the Alcatraz disposal site be done only during the ebb flow of the tide.

Please advise us of your proposed actions concerning these recommendations.

Sincerely yours,

James D. Carson

James J. McKevitt
Field Supervisor

Literature Cited

1. Allen, K.O., and J.W. Hardy. 1980. Impacts of navigational dredging on fish and wildlife: a literature review. U.S. Fish and Wildlife Service, Biological Services Program. FWS/OBS-80/07.

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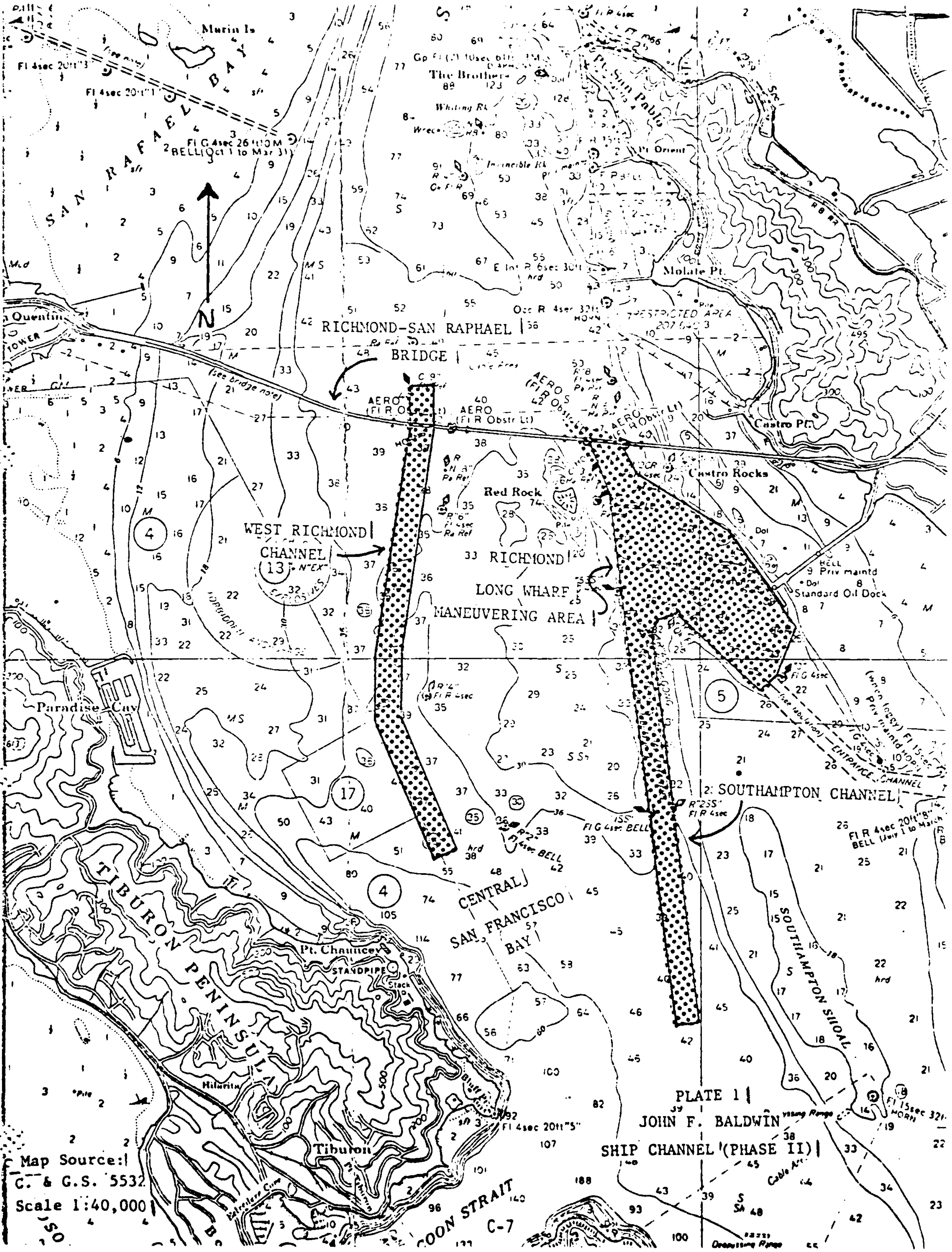


SAN RAFAEL BAY
Marin Is
The Brothers
Pt. San Pablo
Pt. Orient
Molate Pt.
RICHMOND-SAN RAPHAEL BRIDGE
Castro Pt.
Castro Rocks
Red Rock
Standard Oil Dock
WEST RICHMOND CHANNEL
RICHMOND LONG WHARF MANEUVERING AREA
RESTRICTED AREA
Paradise Cay
SOUTHAMPTON CHANNEL
SOUTHAMPTON SHOAL
CENTRAL SAN FRANCISCO BAY
TIBURON PENINSULA
Pt. Chauncey
STANDPIPE
Tiburon
CONCON STRAIT
PLATE 1
JOHN F. BALDWIN SHIP CHANNEL (PHASE II)
Map Source:
C. & G.S. 5532
Scale 1:40,000
C-7

STATE OF CALIFORNIA—RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

DEPARTMENT OF FISH AND GAME
1416 NINTH STREET
SACRAMENTO, CALIFORNIA 95814
(916) 445-3531

October 25, 1982

William D. Sweeney, Area Manager
U.S. Fish & Wildlife Service
2800 Cottage Way, Room E-1803
Sacramento, CA 95825

Dear Mr. Sweeney:

This letter is in response to your June 29, 1982 transmittal regarding your draft report to the Corps of Engineers on the effects that deepening the San Francisco Bay to Stockton Navigation Project (John F. Baldwin Ship Channel - Phase II) would have on fish and wildlife resources.

We have reviewed the report and concur in its findings.

Sincerely,

E C Fullerton

Director

United States Department of the Interior

FISH AND WILDLIFE SERVICE

AREA OFFICE
2800 Cottage Way, Room E-2740
Sacramento, California 95825

APR [illegible] 1982

Mr. Jay K. Soper
Management Division
Department of the Army
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, California 94105

In reply refer to: SESO
#1-1-82-SP-194

Subject: Request for List of Endangered and Threatened Species in the Area of the John F. Baldwin Ship Channel (SF Bay to Stockton), Contra Costa County, California

Dear Mr. Soper:

This is in reply to your letter of March 16, 1982, requesting a list of listed and proposed endangered and threatened species that may occur within the area of the subject project. Your request and this response are made pursuant to Section 7(c) of the Endangered Species Act of 1973 as amended (PL 95-632).

We have reviewed the most recent information and to the best of our knowledge there are no listed or proposed species within the area of the project. We appreciate your concern for endangered species and look forward to continued coordination. If you have further questions, please contact Mr. Swanson of our Endangered Species Field Office at (FTS) 448-2791 or (916) 440-2791.

Sincerely,

Area Manager

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
2800 Cottage Way, Room E-2727
Sacramento, California 95825

April 25, 1984

District Engineer
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105

Subject: Ebb Tide Disposal at Alcatraz, John F. Baldwin Ship Channel, San Francisco Bay to Stockton Navigation Channel

Dear Sir:

This planning aid letter includes our analysis of impacts to fish and wildlife resources of the immediate project area and adjacent San Francisco Bay of discharging dredged spoils at the Alcatraz disposal site during ebb tide phases of the tidal cycles. It does not constitute our detailed report as called for in Section 2 of the Fish and Wildlife Coordination Act.

DESCRIPTION OF THE PROJECT

The John F. Baldwin Ship Channel is located in the lower section of the San Francisco Bay to Stockton Navigation Channel Project (Figure 1). It extends from deep water in the Pacific Ocean to Pt. Edith near the community of Avon in lower Suisun Bay. It is divided into three phases. The completed Phase I segment included deepening of the channel across the San Francisco Bar in the Pacific Ocean to -55 feet MLLW. Phase II, the subject of this report, includes the excavation of the Southampton Shoal Channel (the selected plan) and the Richmond Long Wharf Maneuvering Area to a depth of -45 feet MLLW, 10 feet below the existing depth. The width of the channel will remain at 600 feet (Figure 2). The area to be dredged is approximately 804 acres in size. Initial dredging will remove about 7.9 million cubic yards of material during a 44-month construction period. After completion, annual maintenance dredging will generate an average of 135,000 cubic yards of spoil. All spoils will be disposed at the Alcatraz disposal site irrespective of tidal cycle (U.S. Army Corps of Engineers 1983). Phase III of the John F. Baldwin Ship Channel will include the deepening of the channel to -45 feet MLLW through Pinole Shoal in San Pablo Bay, upper Carquinez Strait, and lower Suisun Bay to Pt. Edith. Presently, deepening of the Stockton Ship Channel from Pt. Edith to Stockton to -35 feet is in progress (Figure 3).

PROJECT IMPACTS

Our analysis of Phase II of the John F. Baldwin Ship Channel Project was provided in our Fish and Wildlife Coordination Act report of November 17,

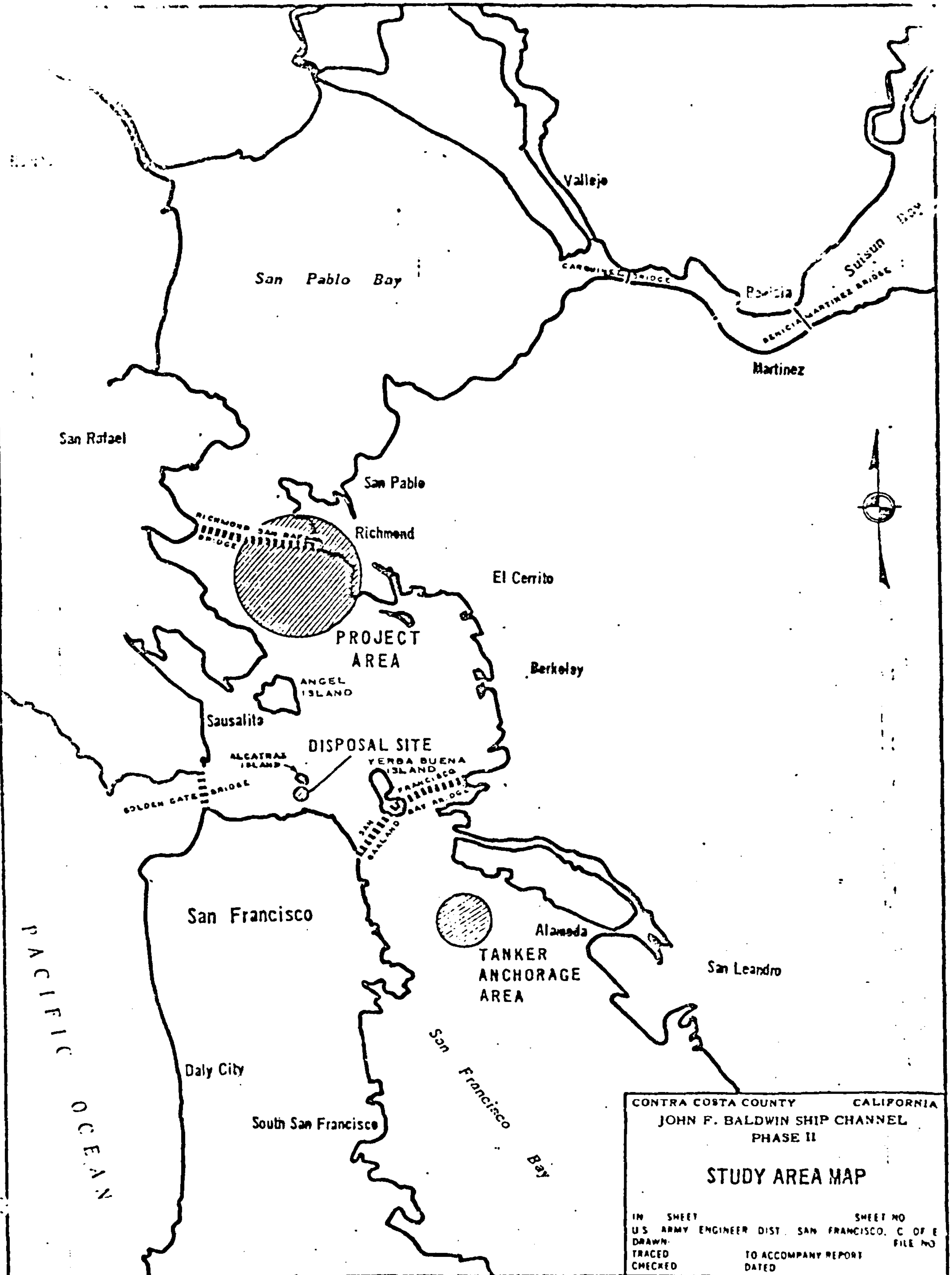
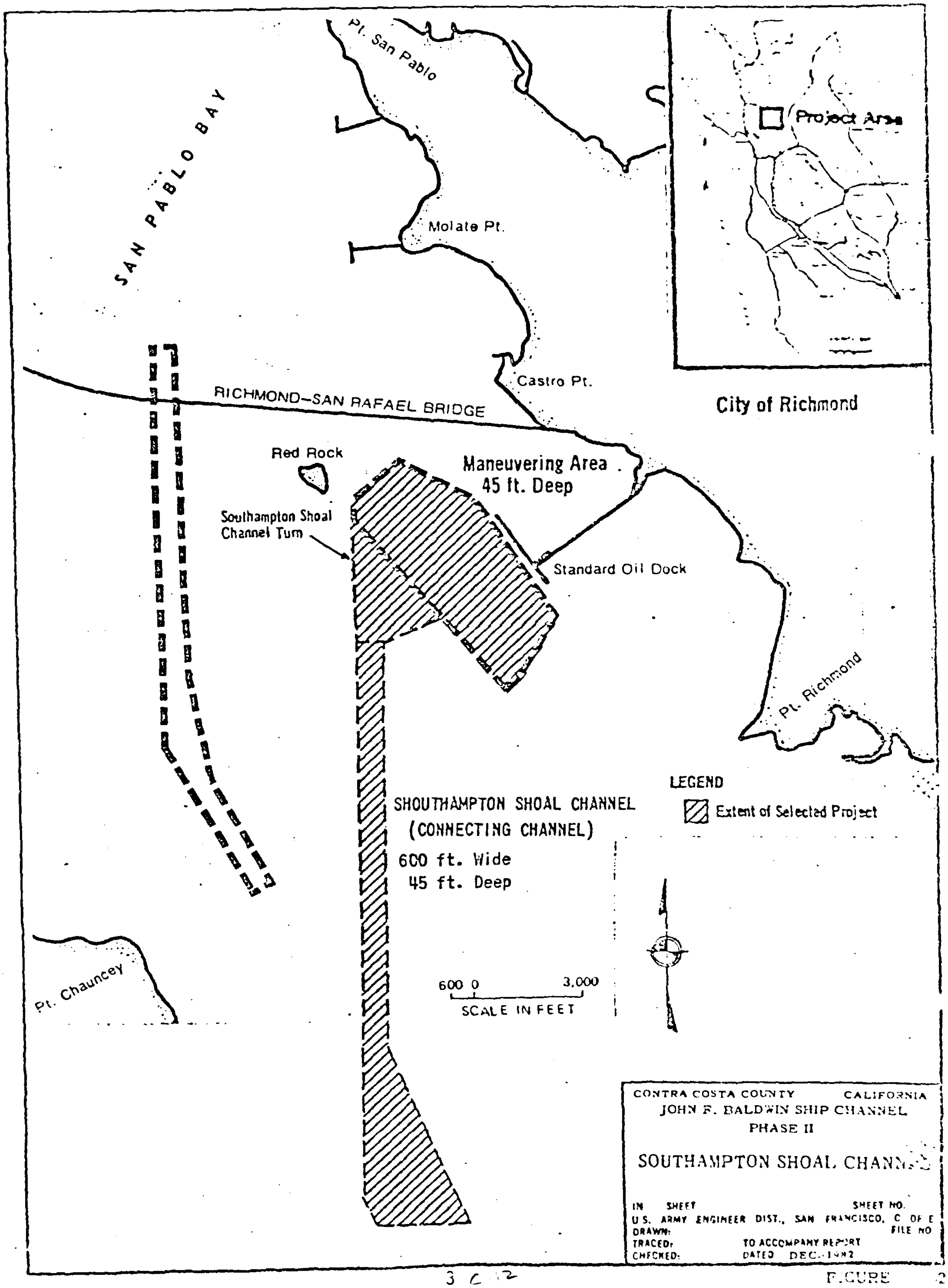

Vallejo
San Pablo Bay
CARQUINEZ BRIDGE
Suisun Bay
BENICIA MARTINEZ BRIDGE
Martinez
San Rafael
San Pablo
Richmond
RICHMOND SAN RAFAEL BRIDGE
El Cerrito
PROJECT AREA
Berkeley
ANGEL ISLAND
Sausalito
DISPOSAL SITE
ALCATRAZ ISLAND
YERBA BUENA ISLAND
GOLDEN GATE BRIDGE
SAN FRANCISCO OAKLAND BAY BRIDGE
San Francisco
Alameda
TANKER ANCHORAGE AREA
San Leandro
PACIFIC OCEAN
Daly City
South San Francisco
San Francisco Bay
CONTRA COSTA COUNTY CALIFORNIA
JOHN F. BALDWIN SHIP CHANNEL
PHASE II
STUDY AREA MAP
IN SHEET SHEET NO
U.S. ARMY ENGINEER DIST. SAN FRANCISCO, C. OF E.
DRAWN FILE NO
TRACED TO ACCOMPANY REPORT
CHECKED DATED

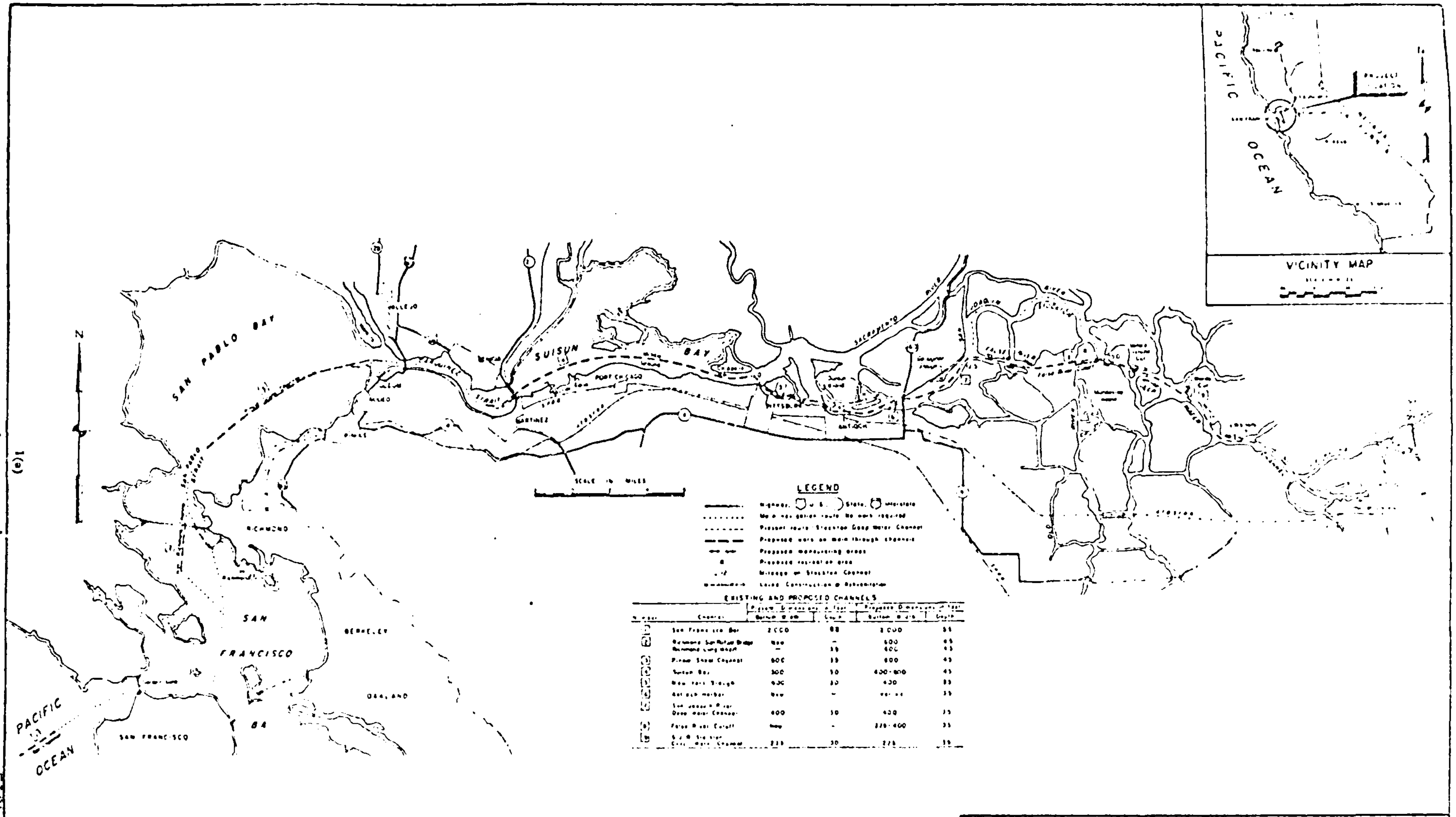
FIGURE 1

C-11



3 C 12

FIGURE 2



EXISTING AND PROPOSED CHANNELS

Number	Channel	Project Dimensions in Feet: Bottom Width	Depth	Proposed Dimensions in Feet: Bottom Width	Depth
1	San Francisco Bar	2000	[illegible]	2000	[illegible]
2	Richmond [illegible]	[illegible]	–	600	45
	Richmond Long Wharf	–	35	600	45
3	Pinole Shoal Channel	600	35	600	45
4	Suisun Bay	300	30	400-800	45
5	New York Slough	400	30	400	[illegible]
6	Antioch Harbor	[illegible]	–	[illegible]	35
7	San Joaquin River Deep Water Channel	400	30	400	35
8	False River Cutoff	[illegible]	–	370-400	35
9	[illegible]	[illegible]	30	[illegible]	35

SAN FRANCISCO BAY TO STOCKTON
(John F. Baldwin and Stockton Ship Channels)
CALIFORNIA

U.S. ARMY ENGINEER DISTRICT
SAN FRANCISCO, CALIFORNIA

1982. In the report, we pointed out that adverse project impacts to aquatic resources will occur due to the extensive area to be dredged, and the large amount of spoil to be deposited at the Alcatraz site. We recognized that technological changes in the ocean shipping industry have resulted in changes in shipping operation within the Bay area. With today's deeper draft vessels, channel and harbor configuration will probably require alterations.

Although we preferred no in-bay spoil disposal, we indicated in the 1982 report that the Alcatraz site was ecologically more desirable than disposal further up the Bay (eg., the Brooks Island dump site). However, still recognizing that in-bay disposal was adverse, especially during all tidal cycles, we recommended that, "Deposition of dredged material at the Alcatraz disposal site be done only during the ebb flow of the tide." Since that time, we have learned that the disposal of 7.9 million cubic yards of spoil is being proposed for the Alcatraz site during all phases of the tidal cycle (U.S. Army Corps of Engineers 1983). We are concerned that the intentional spoi'ing of dredged material in the Bay during incoming tides will cause environmental problems to fish and wildlife in the area. This will occur primarily through the redistribution of sediments and their toxic components. Studies have shown that dredging and aquatic spoil disposal result in turbidity, sedimentation, burial of organisms, changes in substrate composition and bottom topography, and releases of noxious materials and biostimulants (U.S. Army Corps of Engineers July 1975). Each one of these conditions can cause stress and elimination of aquatic fauna and flora in the area, and contribute to the instability of the environment. The degree of impact, in this instance, is dependent on the magnitude of spoil disposal during non-ebb tide periods. Theoretically, all off-loading of spoil at Alcatraz could occur on the incoming tide. In that event, all spoil (7.9 million cubic yards) will be retained in the Bay. In contrast, most spoil could be removed from the area if all disposal occurred on the ebb tide cycle. However, it is unlikely that either of the two situations will occur because the current proposal is to off-load spoils at all tidal cycles (U.S. Army Corps of Engineers,December 1983).

There is concern that the large amount of sediment in the Bay system will result in continuous dredging and the subsequent disposal of spoil at Alcatraz and at other locations in the Bay. Field and laboratory studies have been conducted to determine the origin, distribution,sedimentation, and shoaling conditions, and their impacts on navigation and the ecological community.

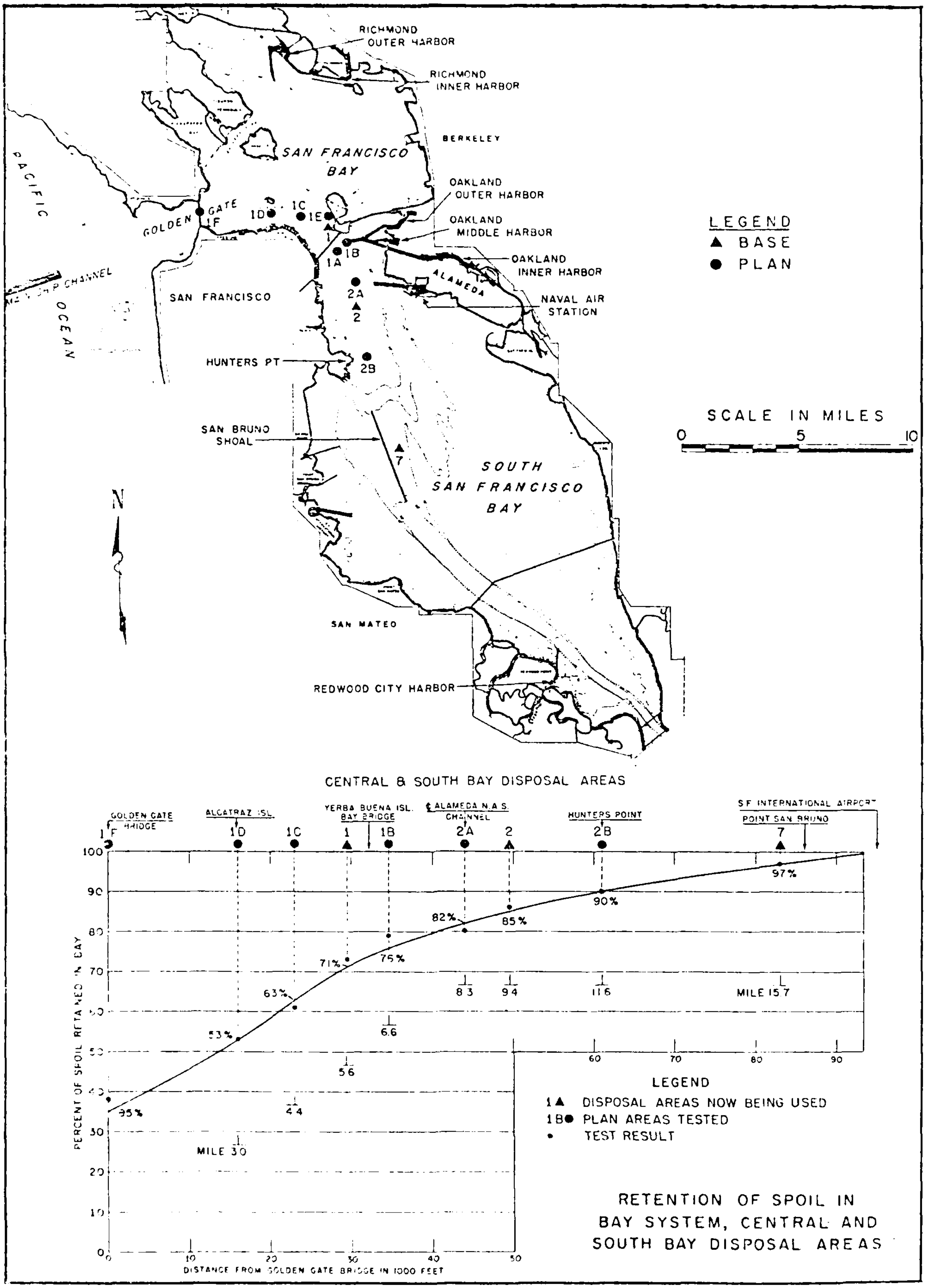
Sediment inflow to the Bay, as a result of erosive forces in the Central Valley and adjoining Bay drainage systems, is estimated at 10 million cubic yards per year (U.S. Army Corps of Engineers, 1967). This inflow of sediment is not, for the most part, carried directly to the ocean. A large percentage remains in the Bay for a number of years before reaching the ocean. It is deposited, then resuspended, recirculated, and redeposited elsewhere, and eventually transported toward the mouth of the estuary and out of the Bay system into the ocean as suspended load and bedload (Sustar 1982). However, some sediment is permanently retained in the system. It is deposited and accumulated in low-energy areas where wind-wave action,

and water flow volumes and velocities are not great enough to transport sediments. These areas may be found along the margins of the Bay such as intertidal flats, marshes, and inlets, as well as around man-made structures and dredged channels (U.S. Army Corps of Engineers, December 1975). Investigations, concerning sediment movement associated with dredged disposal studies, have shown that the layer of active sediments -- sediments subject to mixing and recirculation -- was found to be at least nine inches thick. In some instances, this layer can be more than two feet below the Bay bottom in shallows and flats, indicating that major mixing occurs during and after deposition (U.S. Army Corps of Engineers, December 1975). This condition, although a natural process of estuarine dynamics, contributes to benthic organism instability. Little can be done to correct this natural process.

This same situation (sediment distribution, resuspension, etc.) exists with dredged spoil disposal. It is estimated that approximately 10.5 million cubic yards of Bay sediments are dredged annually in the Bay system. The majority of these sediments are released in the Bay at three open water disposal sites (U.S. Army Corps of Engineers, August 1977). With 10 million cubic yards being redistributed from dredge spoil disposal, 20 million cubic yards of sediments are constantly contributing to Bay instability, impacting fish and wildlife resources.

Studies concerning in-bay spoil disposal have been conducted. A study of spoil disposal at Alcatraz during all tidal cycles showed that 53 percent or almost 4 million cubic yards of the planned disposal (7.9 million cubic yards) will be retained in the Bay, while the remaining 47 percent would be swept out to sea. The study also showed that disposal on the two ebb tides during the 24.84 hour tidal cycle resulted in 29 percent or 2.29 million cubic yards being retained in the Bay, while 71 percent of the material was carried out to sea (U.S. Army Corps of Engineers, 1967). Dumping once a day on the strongest (fastest) of the two ebb tides resulted in 80 percent or 6.32 million cubic yards being carried out to sea and 20 percent or 1.6 million cubic yards being retained in the Bay. Figure 4 shows the percentage of spoil retained in the entire Bay system when dumped at this and other spoil locations during all tidal cycles. It indicates that less spoil is retained in the Bay when dumping occurs closest to the Golden Gate site (35%) than farther up-bay at Pinole Shoal (96%). Spoils retained in the Bay after disposal at the Alcatraz site have been observed covering an area extending from the Pacific Ocean through South and Central San Francisco Bays and San Pablo Bay to Carquinez Strait.

The disposal of 7.9 million cubic yards of spoil from the initial dredging of Phase II channel is only a part of the total dredge spoil disposal planned for Alcatraz. The planned deepening of Oakland Inner Harbor will add an additional 5 million cubic yards or more over a two year period. In addition, other dredging projects utilize the site. In 1975, it was estimated that approximately 2.1 million cubic yards of Corps' dredged material are disposed at Alcatraz every year, plus another 1.2 million cubic yards by other interests for a total of 3.3 million cubic yards (U.S. Army Corps of Engineers, 1975). Since that time, we have learned that possibly more than twice that amount may be annually deposited at the site. We mention this because the total amount of sediment deposition is limiting



RETENTION OF SPOIL IN BAY SYSTEM, CENTRAL AND SOUTH BAY DISPOSAL AREAS

FIGURE 4

shellfish bed and other benthic organism expansion, and impacting the nursery and feeding areas, and migratory routes of fish, shrimp and crab. An example of impacts to some major economic species in the vicinity of the Alcatraz disposal site are indicated in the distributional maps (Figures 5 through 10). The continual deposition at this point and constant re-suspension of sediments is prolonging the instability of the environment in excess of the natural process.

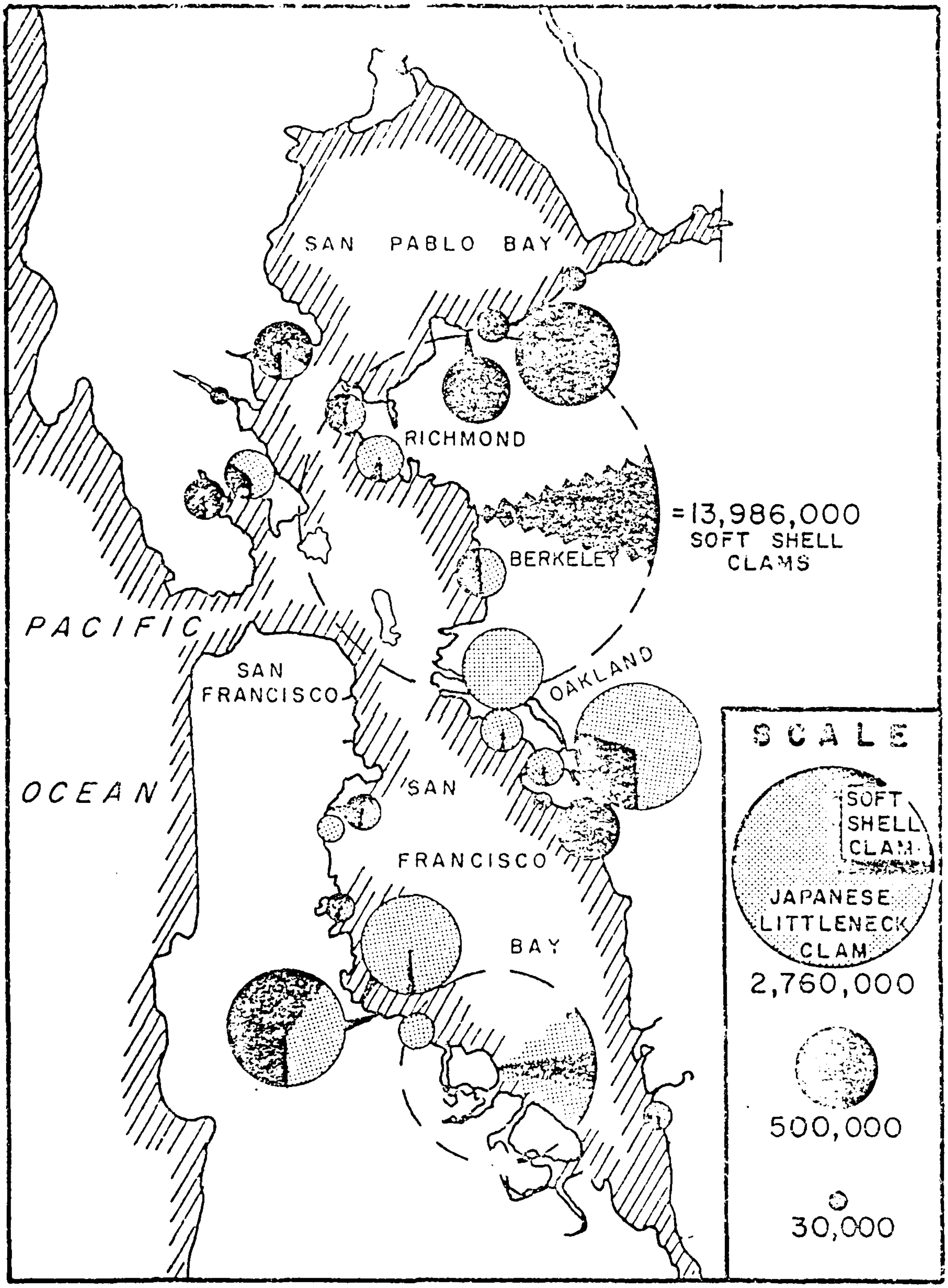
Disposal during ebb tide only will reduce this man-made impact by more than fifty percent.

ECONOMICS OF SPOIL DISPOSAL

The cost of dredged spoil disposal is a major factor in disposal site selection and timing. The basic cost of disposing of 7.9 million cubic yards of spoil at Alcatraz, without considering administration, engineering, contingencies and other costs, is $3.95 per cubic yard, totaling $31,111,000 (U.S. Army Corps of Engineers, 1983). As indicated earlier, studies have shown that 53 percent or approximately 4 million cubic yards will be returned to the Bay if disposal occurred at all tide conditions. This will settle out in navigation channels and low-energy sites such as boat harbors, tidal flats, and marsh areas. If only one-half of the 4 million cubic yards or 2 million cubic yards settled in navigation channels and harbor areas, thereby requiring additional dredging (a second time), the cost to remove the material will be $7,900,000. We mention this because it was indicated that only ebb tide disposal will increase disposal cost (approximately $3.7 million) over the proposed in-water spoiling, irrespective of the tides (U.S. Army Corps of Engineers, 1983). In addition, if a third dredging is required to remove the 0.5 million cubic yards which again settled in navigation channels and harbors, then the additional cost would be $1,975,000 at $3.95/cubic yards. Consequently, dredging the original amount (7.9 million cubic yards) and redredging a second (2 million cubic yards) and third time (0.5 million cubic yards) will add $9,875,000 to the original cost of dredging due to spoiling irrespective of tidal conditions.

In contrast, it appears that a decided economic savings would occur by spoiling during the strongest ebb tide when only 20 percent of the initial spoil is returned to the Bay, or during the two ebb tides when 29 percent of the initial material is returned to the Bay.

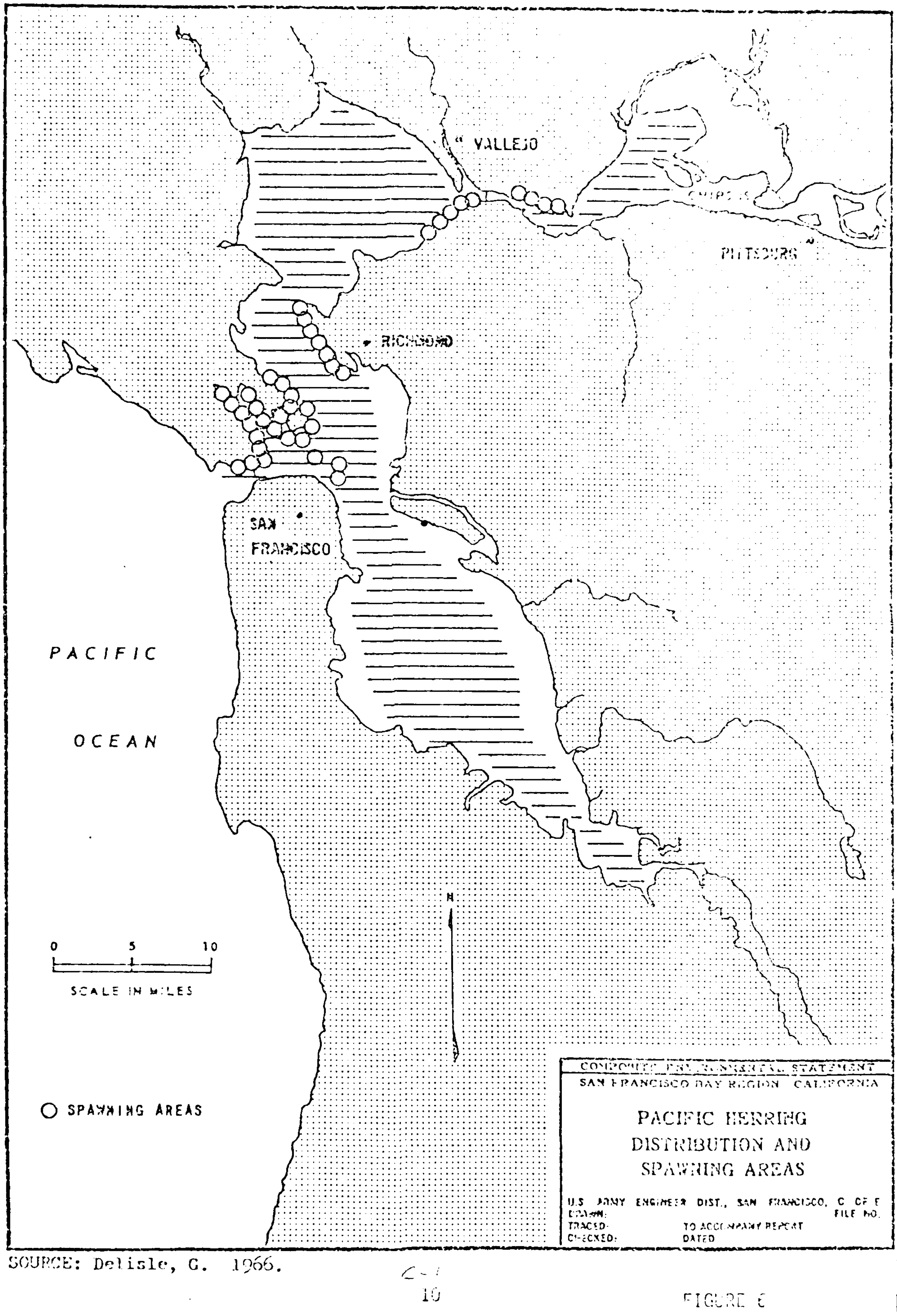
We are concerned that the economic analysis of this project includes only the non-environmental costs of dredging and spoil disposal. No consideration is given to the economic impacts of reduced fish and wildlife numbers caused by spoil dispersion, and the impacts of habitat instability and loss as a result of excess sedimentation. Although difficult to assess, the spoiling of 7.9 million cubic yards of material to the aquatic environment from this project, and the annual deposition of 10.5 million cubic yards of maintenance dredged spoil is suppressing fish and wildlife populations, thereby resulting in economic losses. A good example is the spawning of Pacific herring in the vicinity of the Alcatraz spoil disposal fall-out area (Figure 6). Studies conducted by California Department of Fish and Game indicate that herring, when ready to spawn, move into the



Major clam beds in intertidal zone of San Francisco Bay, 1967. Area of circle is proportional to estimated adult population.

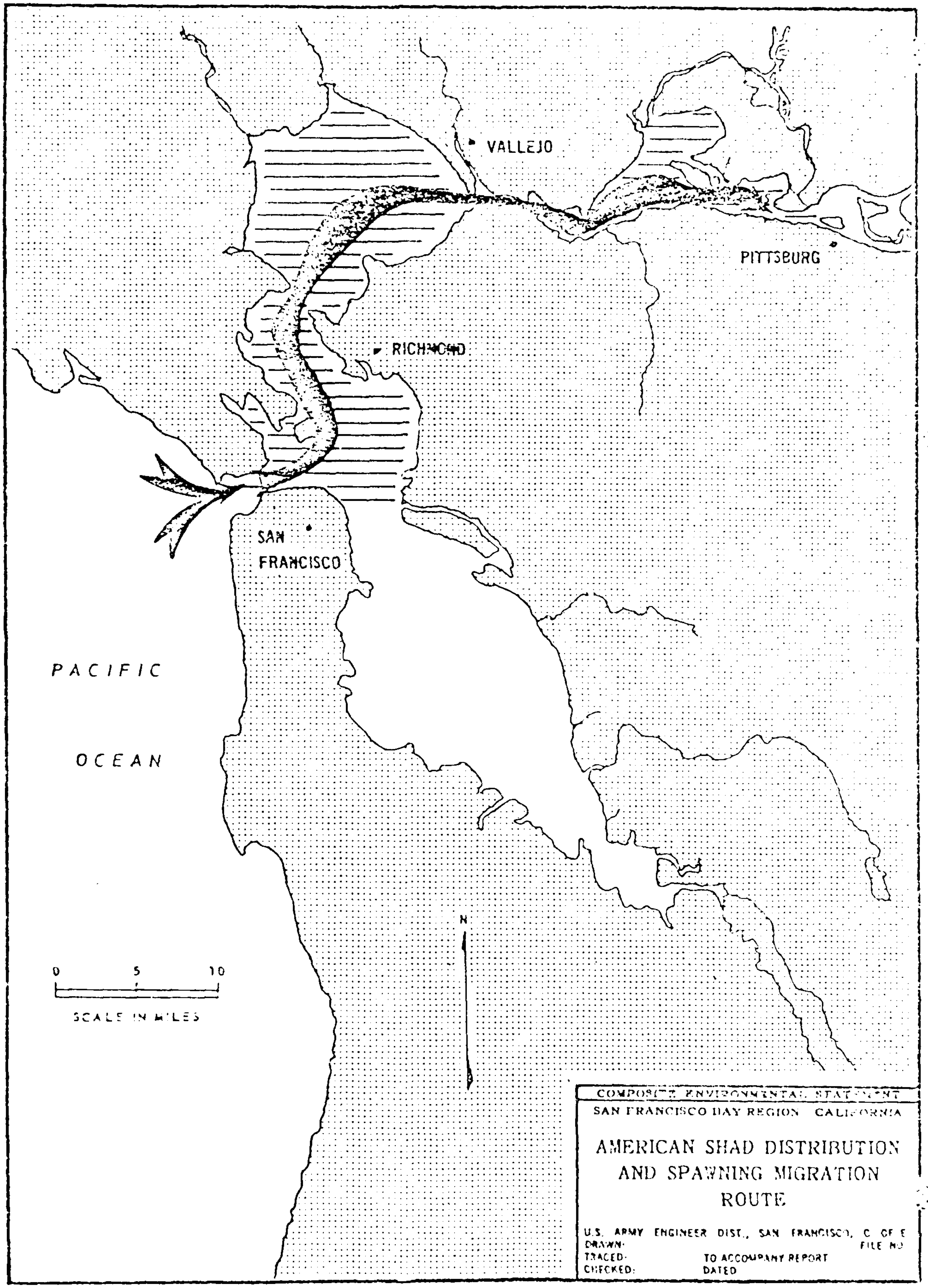
Source: Wooster, T.W. 1968.

FIGURE 5



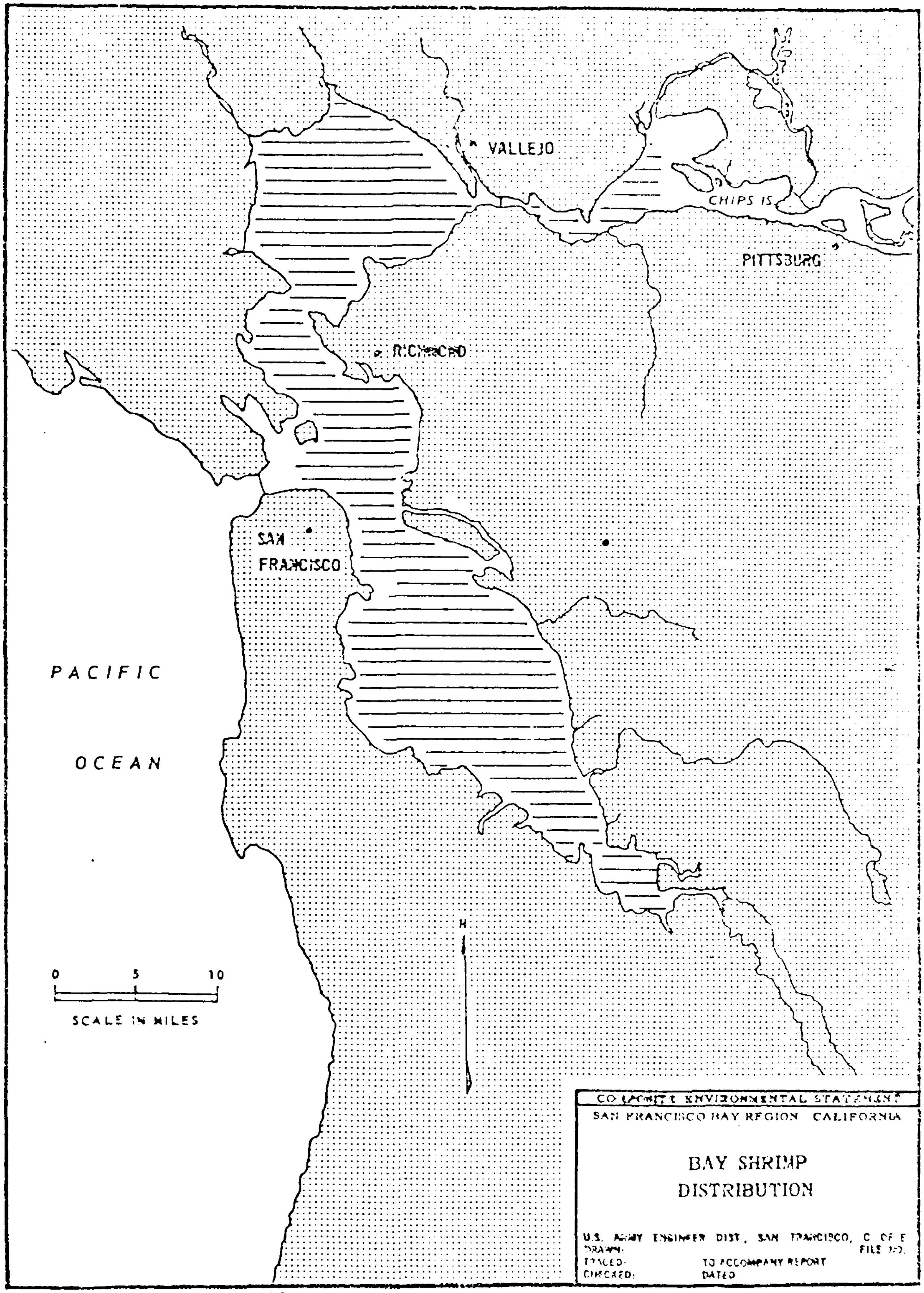
SOURCE: Delisle, G. 1966.

FIGURE 6



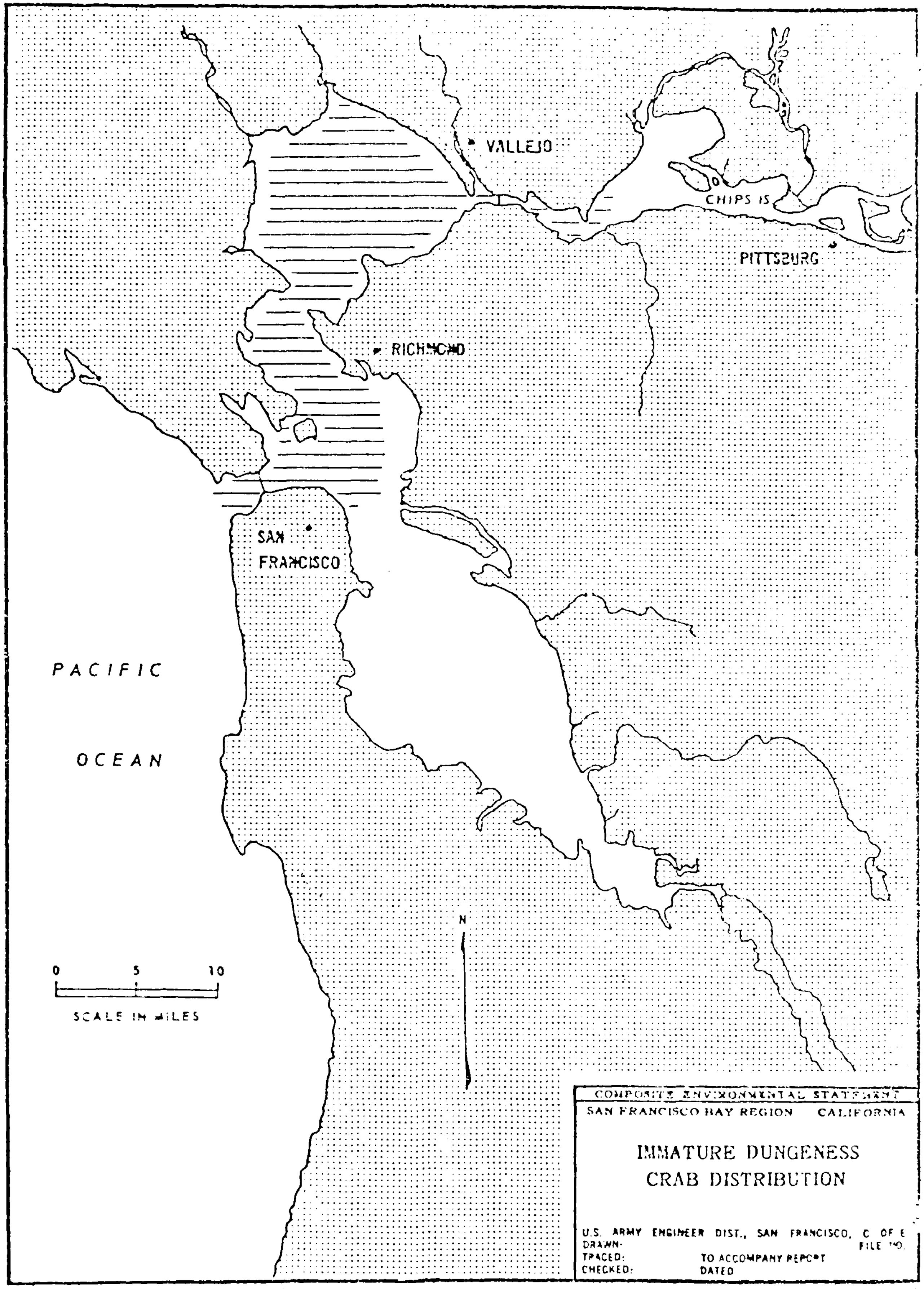
SOURCE: Delisle, G. 1966.

FIGURE 7



Source: Delisle, C. 1966.

FIGURE 8



SOURCE: Delisle, C, 1966.

C-22

FIGURE 2

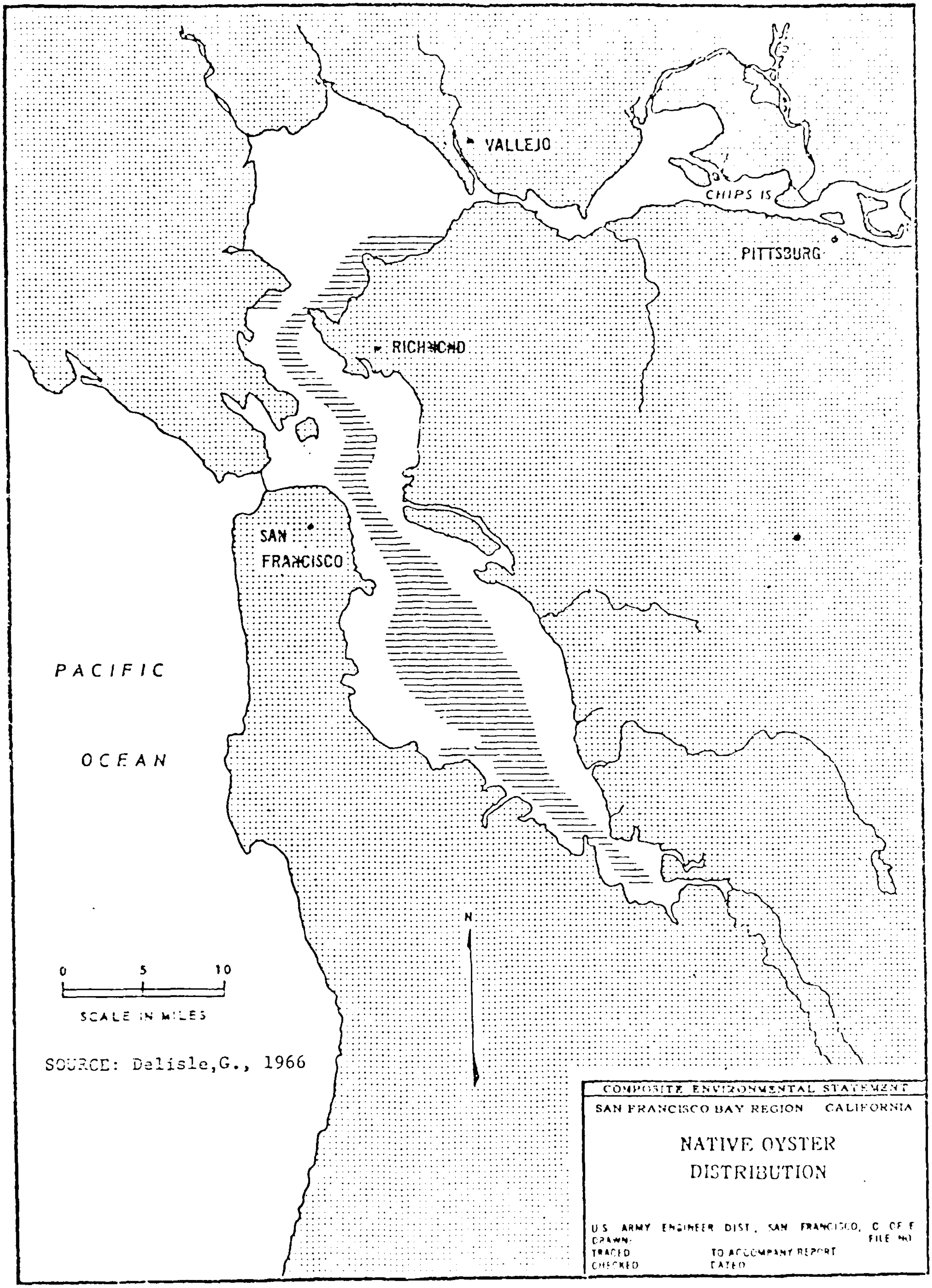

VALLEJO
CHIPS IS
PITTSBURG
RICHMOND
SAN FRANCISCO
PACIFIC
OCEAN
N
0 5 10
SCALE IN MILES
SOURCE: Delisle,G., 1966
COMPOSITE ENVIRONMENTAL STATEMENT
SAN FRANCISCO BAY REGION CALIFORNIA
NATIVE OYSTER DISTRIBUTION
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C. OF E.
DRAWN: FILE NO
TRACED TO ACCOMPANY REPORT
CHECKED DATED

FIGURE 10

shallow intertidal and subtidal areas searching for the right substrate type. In San Francisco Bay, mud bottoms without vegetation are about the only type of substrate the fish will not spawn on (California Department of Fish and Game, 1983). Numerous other examples of unstable benthic areas are evident. Although the increase in spawning success and the subsequent increase in economic value that would be realized without the contribution of in-bay spoil is unknown, it is expected to be significant. Ebb tide disposal will reduce the existing sediment load in the area and definitely contribute to the economic values of fish and wildlife resources.

CONCLUSION

Although all spoil disposal in the Bay will have an adverse impact on fish and wildlife resources, ebb tide disposal at the Alcatraz disposal site is considered the most ecologically desirable of the existing three disposal areas. Presently, we are concerned with the buildup of spoils at the Alcatraz site to -30 feet MLLW. However, we have been informed by your staff that the mound is eroding and the amount of unauthorized material will be reduced. This has resulted in a decision to use the Alcatraz site as the dredge disposal site. In the event mounding presents a problem with disposal at the Alcatraz site, we will recommend that disposal occur further seaward on the ebb tide.

RECOMMENDATION

Our recommendation for the current disposal practices, pending the outcome of the existing mound, remains the same as our report of November 17, 1982.

We recommended that:

1. Deposition of dredged material at the Alcatraz disposal site be done only during the ebb flow of the tide.

We appreciate the opportunity to provide input to your planning process for this project.

Sincerely,

James J. McKevitt
Field Supervisor

cc: NMFS, Tiburon (Tom Yocum)
Director, CDFG, Sacramento
EPA, San Francisco, (Lilly Wong)

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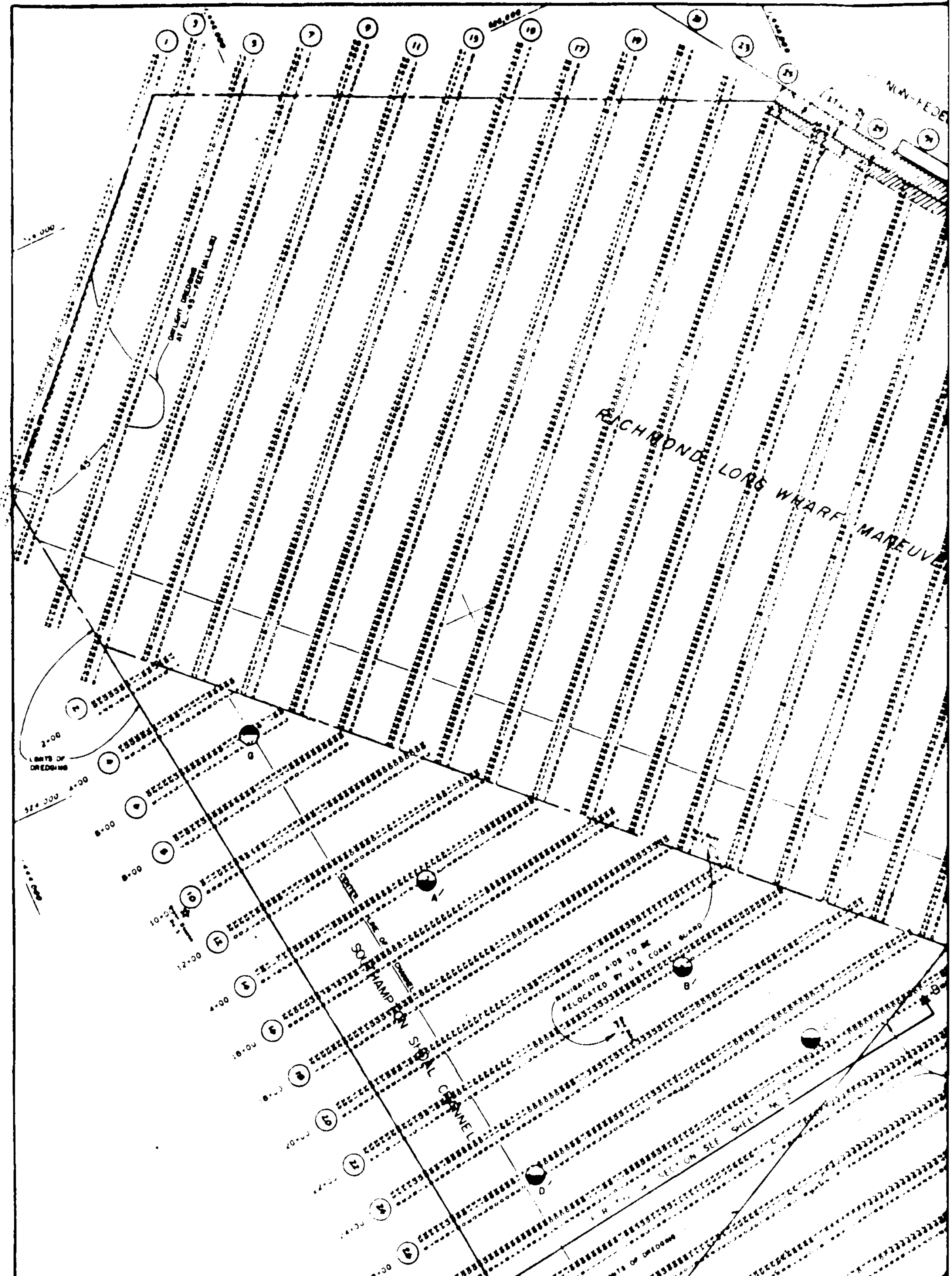
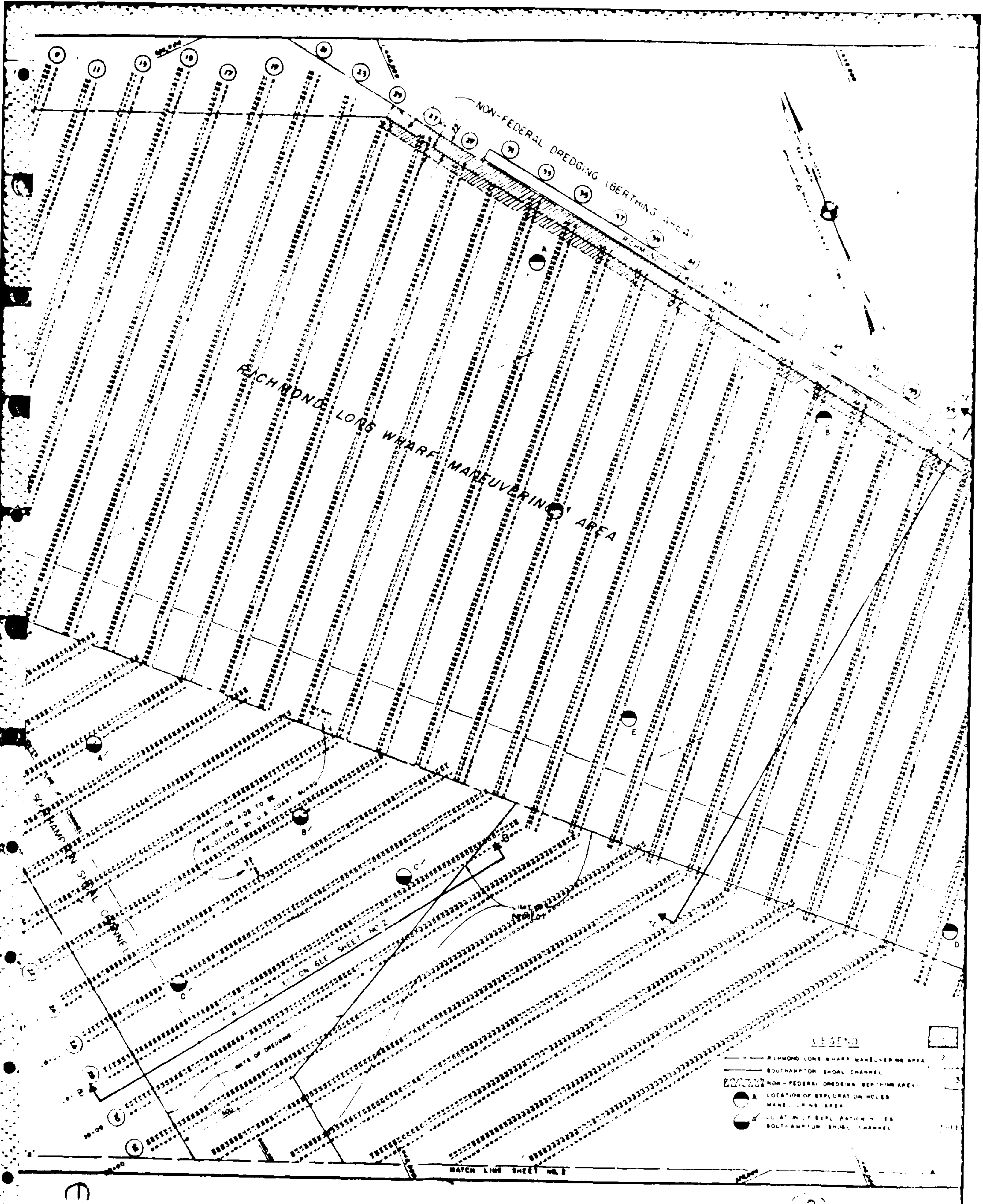
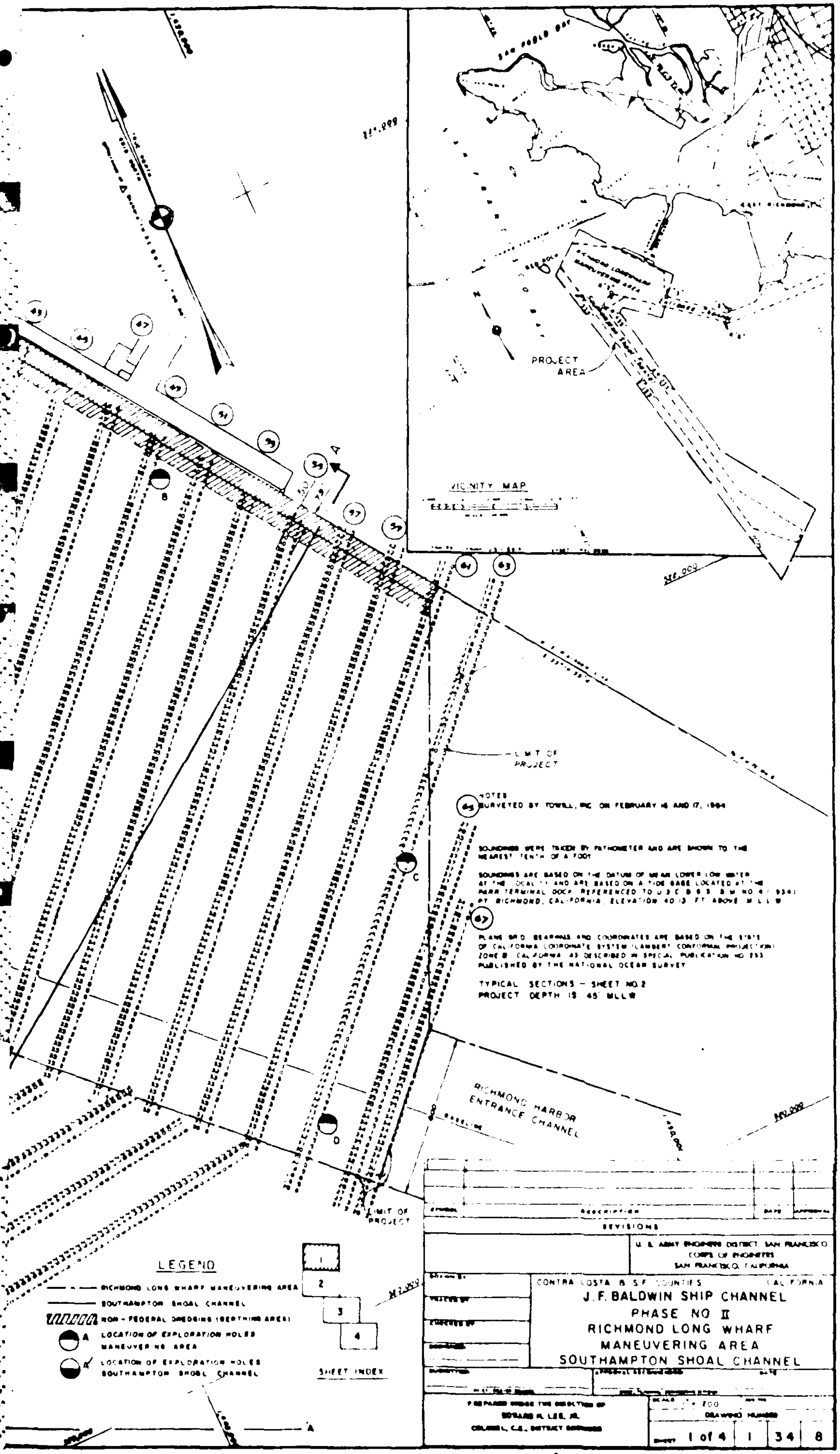
APPENDIX D
ENGINEERING DRAWINGS

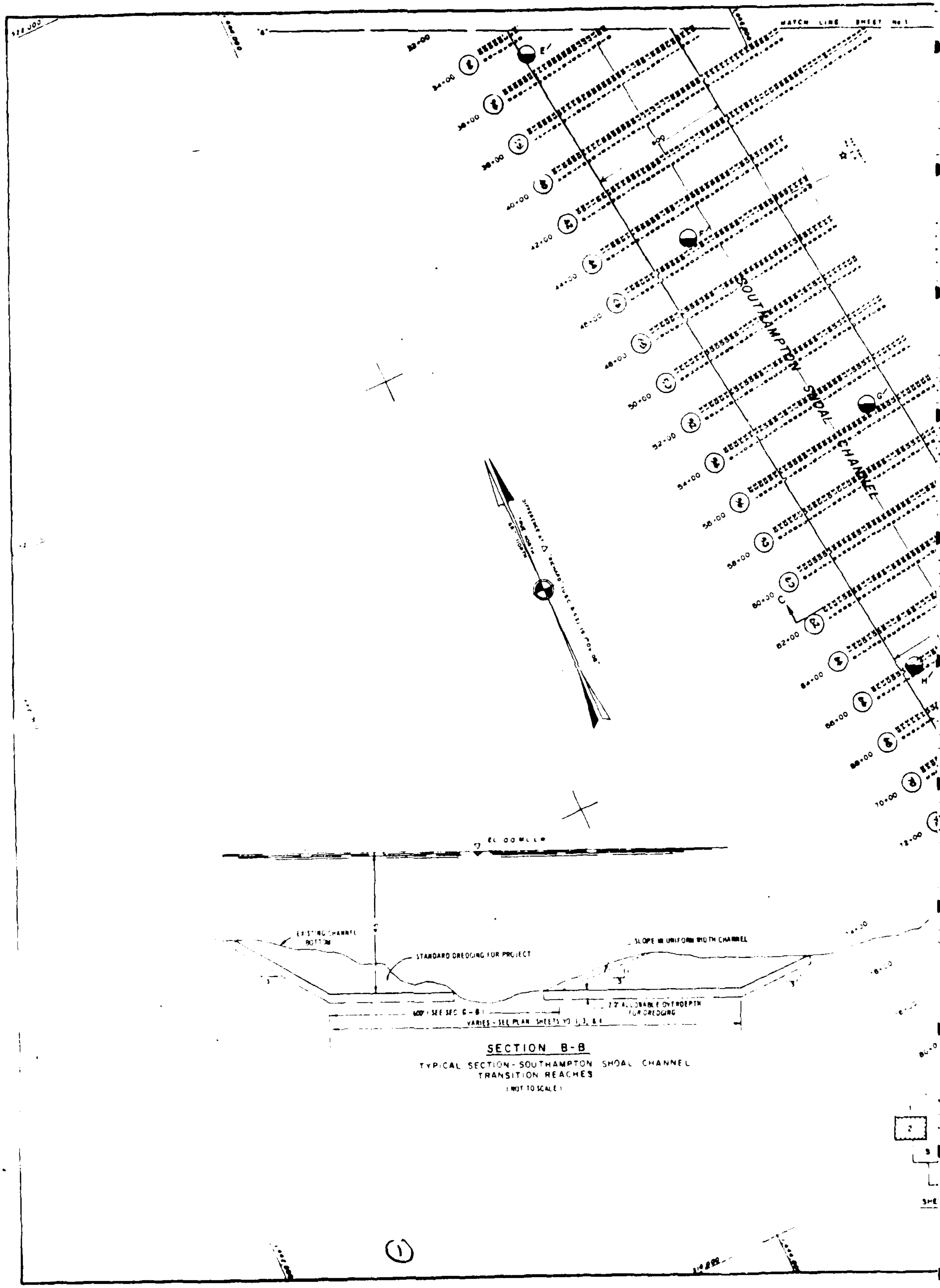


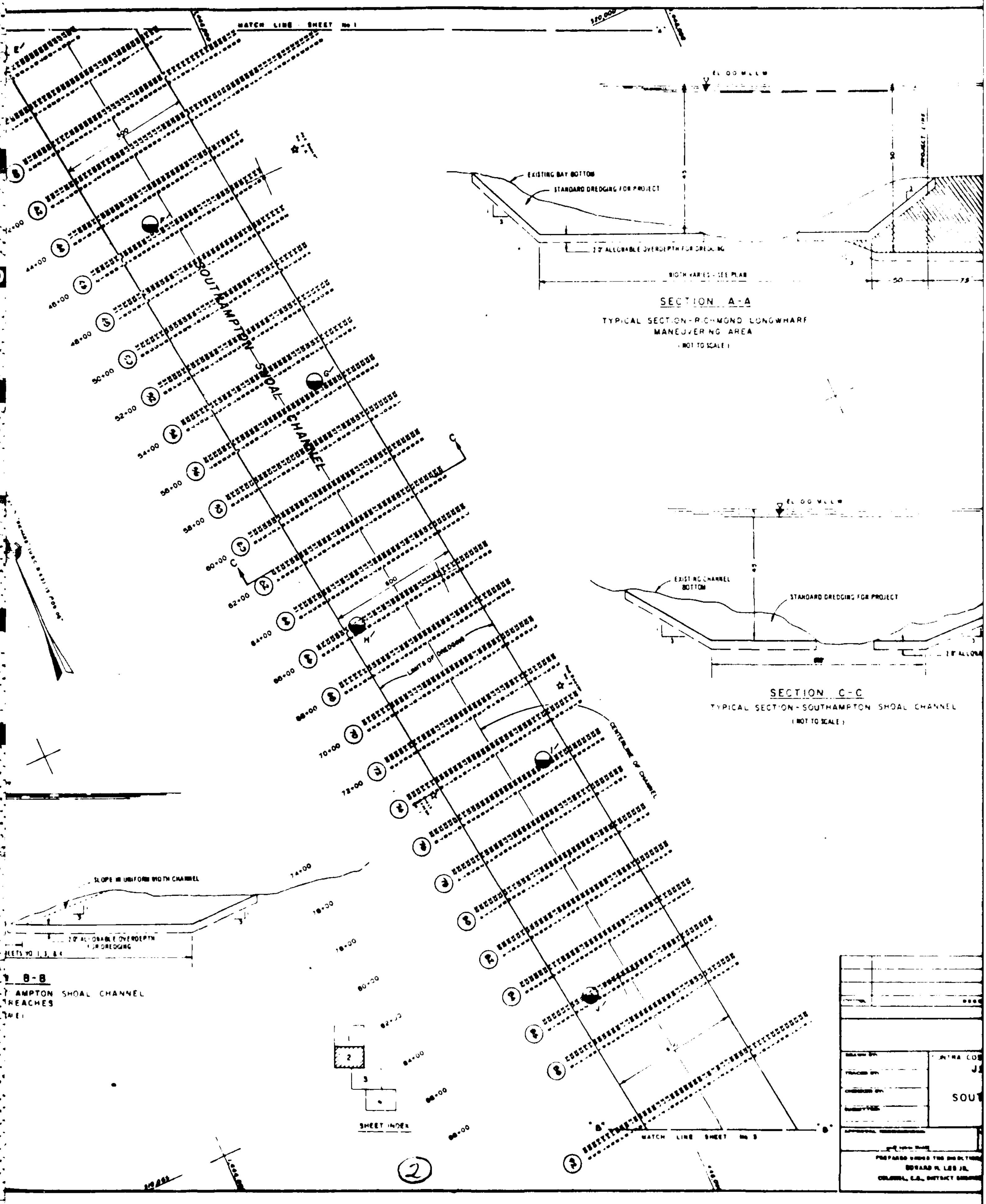
RICHMOND LONG WHARF MANEUV
SOUTHAMPTON SHOAL CHANNEL
NAVIGATION AIDS TO BE RELOCATED BY U.S. COAST GUARD
LIMITS OF DREDGING
MATCH LINE
NON-FEDE

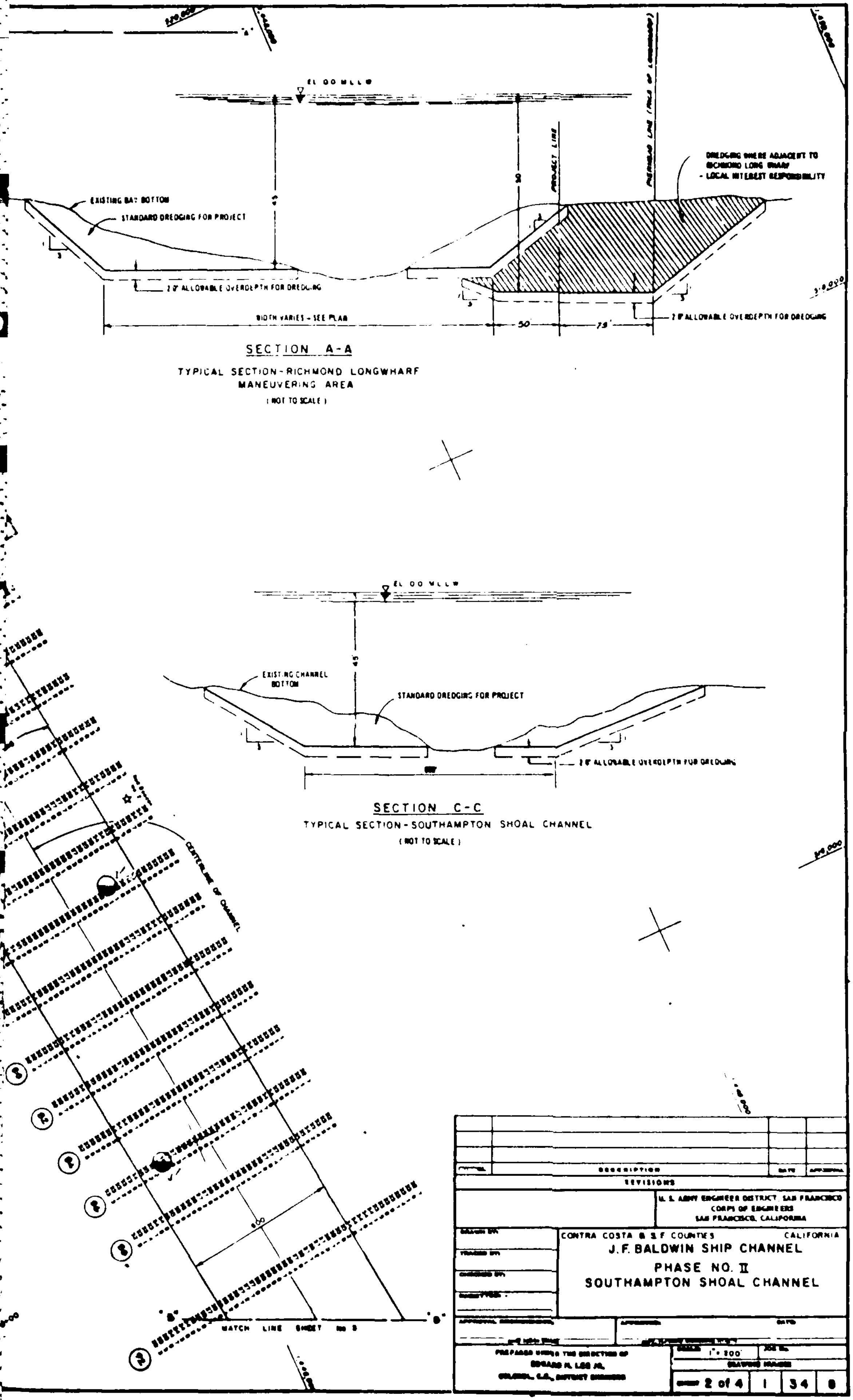

NON-FEDERAL DREDGING (BERTHING AREA)
RICHMOND LONG WHARF MANEUVERING AREA
SOUTHAMPTON SHOAL CHANNEL
MATCH LINE SHEET NO. 2
LEGEND
RICHMOND LONG WHARF MANEUVERING AREA
SOUTHAMPTON SHOAL CHANNEL
NON-FEDERAL DREDGING (BERTHING AREA)
LOCATION OF EXPLORATION HOLES MANEUVERING AREA
SOUTHAMPTON SHOAL CHANNEL


VICINITY MAP
PROJECT AREA
LIMIT OF PROJECT
RICHMOND HARBOR ENTRANCE CHANNEL
NOTES
SURVEYED BY TOWILL, INC. ON FEBRUARY 16 AND 17, 1984
SOUNDINGS WERE TAKEN BY FATHOMETER AND ARE SHOWN TO THE NEAREST TENTH OF A FOOT
SOUNDINGS ARE BASED ON THE DATUM OF MEAN LOWER LOW WATER AT THE LOCALITY AND ARE BASED ON A TIDE BASE LOCATED AT THE PARR TERMINAL DOCK, REFERENCED TO U.S.C. & G.S. B.M. NO. 6 (1934) PT. RICHMOND, CALIFORNIA, ELEVATION 40.13 FT. ABOVE M.L.L.W.
PLANE GRID, BEARINGS AND COORDINATES ARE BASED ON THE STATE OF CALIFORNIA COORDINATE SYSTEM (LAMBERT CONFORMAL PROJECTION) ZONE III, CALIFORNIA, AS DESCRIBED IN SPECIAL PUBLICATION NO. 253 PUBLISHED BY THE NATIONAL OCEAN SURVEY
TYPICAL SECTIONS - SHEET NO. 2
PROJECT DEPTH IS 45' MLLW
LEGEND
RICHMOND LONG WHARF MANEUVERING AREA
SOUTHAMPTON SHOAL CHANNEL
NON-FEDERAL DREDGING (BERTHING AREA)
A LOCATION OF EXPLORATION HOLES MANEUVERING AREA
A' LOCATION OF EXPLORATION HOLES SOUTHAMPTON SHOAL CHANNEL
SHEET INDEX
REVISIONS
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
CONTRA COSTA & S.F. COUNTIES CALIFORNIA
J.F. BALDWIN SHIP CHANNEL
PHASE NO II
RICHMOND LONG WHARF
MANEUVERING AREA
SOUTHAMPTON SHOAL CHANNEL
PREPARED UNDER THE DIRECTION OF
EDWARD M. LEE, JR.
COLONEL, C.E., DISTRICT ENGINEER
DRAWING NUMBER
SHEET 1 of 4 1 34 8

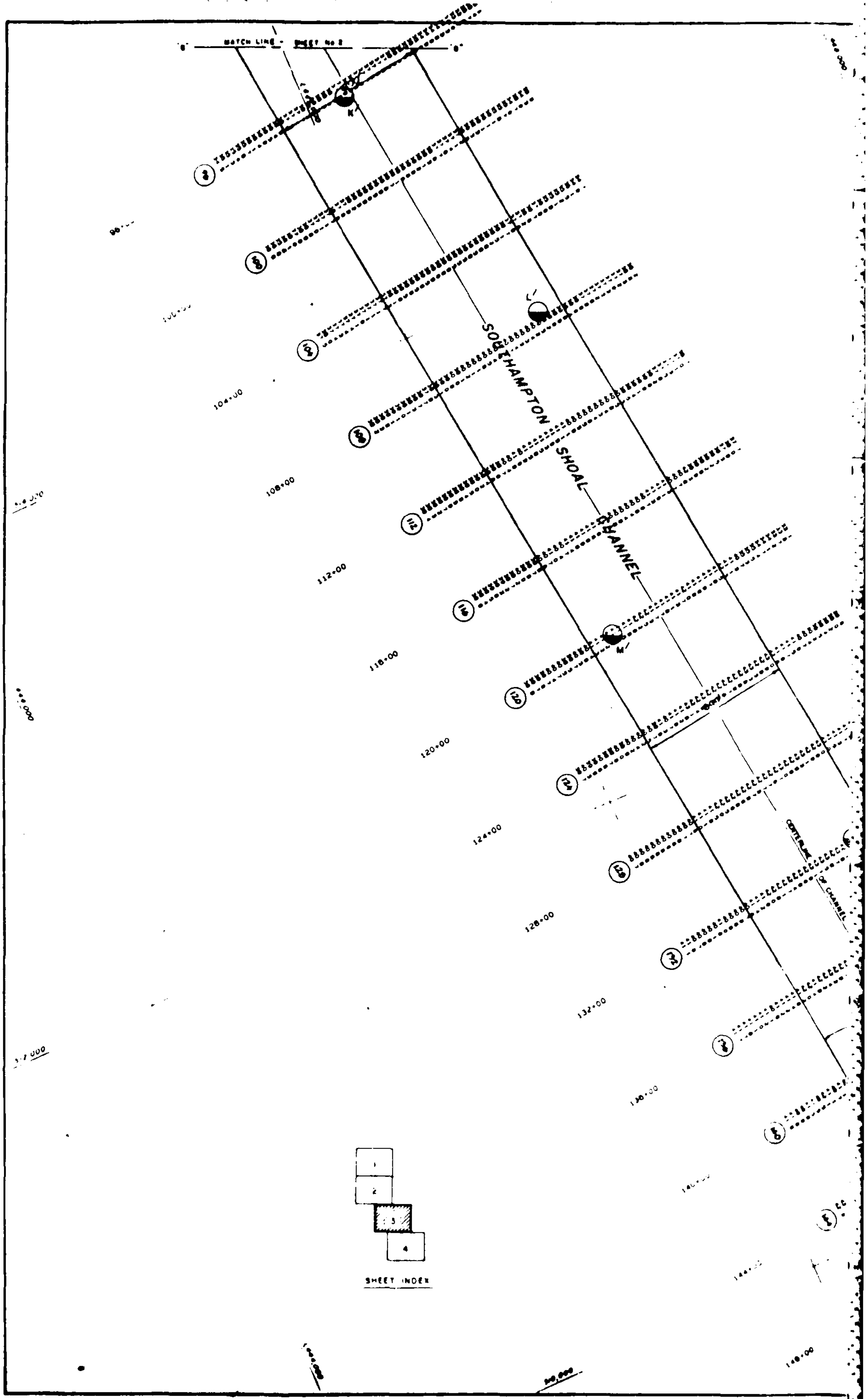
3


MATCH LINE SHEET No 1
SOUTHAMPTON SHOAL CHANNEL
34+00
36+00
38+00
40+00
42+00
44+00
46+00
48+00
50+00
52+00
54+00
56+00
58+00
60+00
62+00
64+00
66+00
68+00
70+00
72+00
EXISTING CHANNEL BOTTOM
STANDARD DREDGING FOR PROJECT
SLOPE IN UNIFORM WIDTH CHANNEL
2' ALLOWABLE OVERDEPTH FOR DREDGING
SECTION B-B
TYPICAL SECTION - SOUTHAMPTON SHOAL CHANNEL
TRANSITION REACHES
(NOT TO SCALE)


MATCH LINE SHEET No 1
SOUTHAMPTON SHOAL CHANNEL
EL 0.0 MLLW
EXISTING BAY BOTTOM
STANDARD DREDGING FOR PROJECT
2.0' ALLOWABLE OVERDEPTH FOR DREDGING
WIDTH VARIES - SEE PLAN
PROJECT LINE
SECTION A-A
TYPICAL SECTION - RICHMOND LONGWHARF MANEUVERING AREA
(NOT TO SCALE)
EXISTING CHANNEL BOTTOM
SECTION C-C
TYPICAL SECTION - SOUTHAMPTON SHOAL CHANNEL
(NOT TO SCALE)
LIMITS OF DREDGING
CENTERLINE OF CHANNEL
SLOPE IN UNIFORM WIDTH CHANNEL
2.0' ALLOWABLE OVERDEPTH FOR DREDGING
B-B
AMPTON SHOAL CHANNEL
REACHES
SHEET INDEX
MATCH LINE SHEET No 3
2

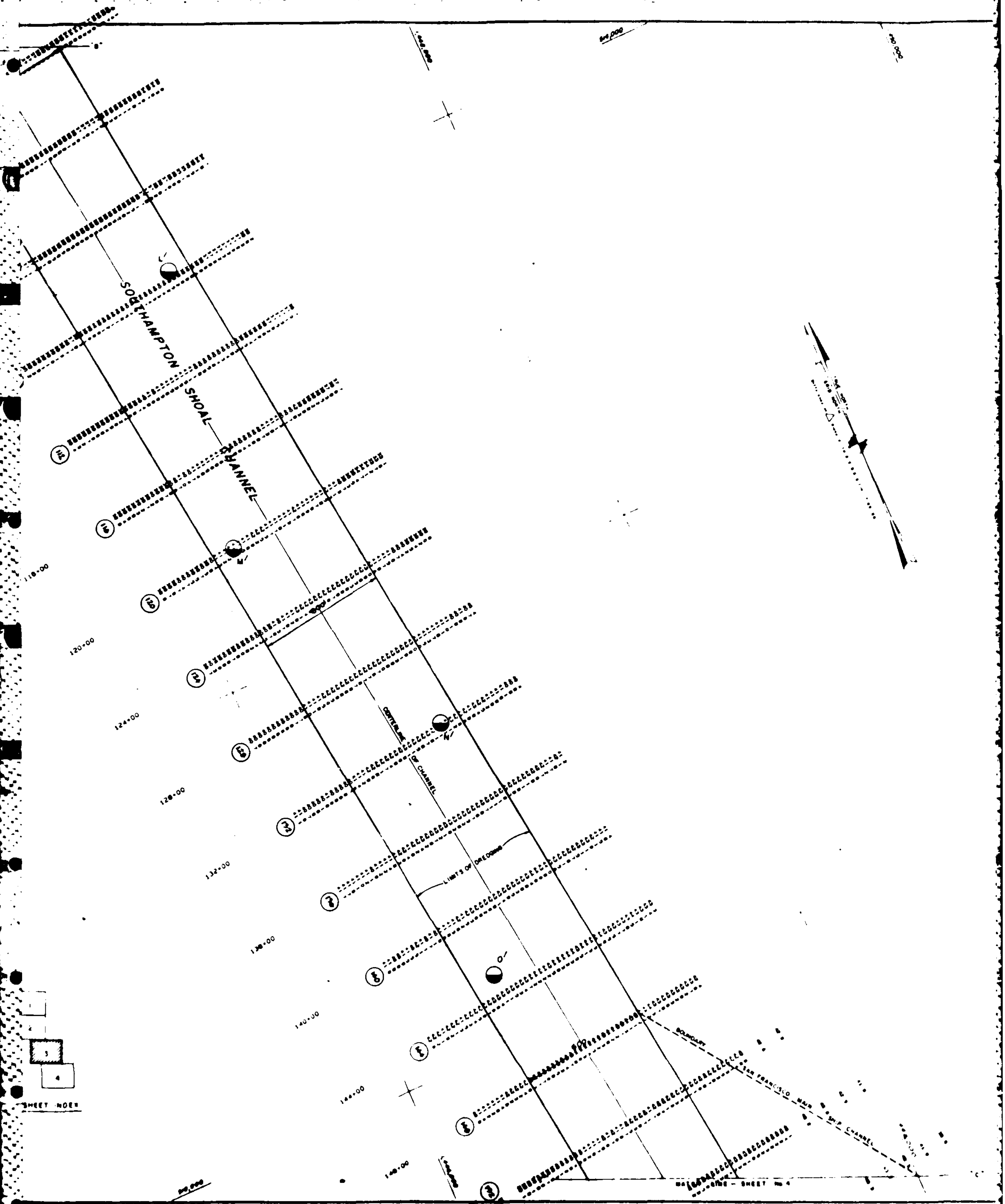


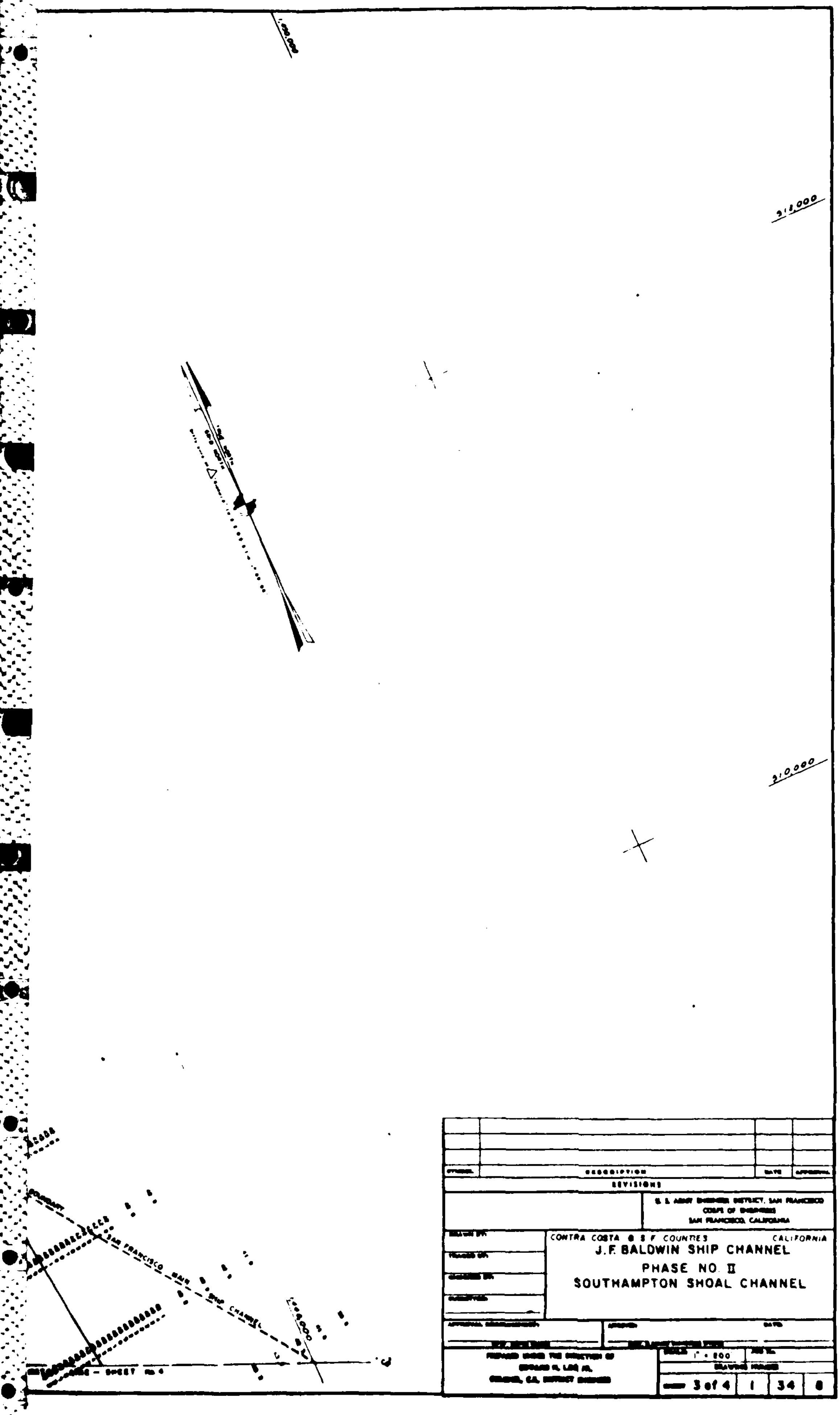
EL 0.0 MLLW
EXISTING BAY BOTTOM
STANDARD DREDGING FOR PROJECT
PROJECT LINE
DREDGING WHERE ADJACENT TO RICHMOND LONG WHARF - LOCAL INTEREST RESPONSIBILITY
45
50
2.0' ALLOWABLE OVERDEPTH FOR DREDGING
WIDTH VARIES - SEE PLAN
50'
75'
SECTION A-A
TYPICAL SECTION - RICHMOND LONGWHARF MANEUVERING AREA
(NOT TO SCALE)
EL 0.0 MLLW
EXISTING CHANNEL BOTTOM
STANDARD DREDGING FOR PROJECT
45
2.0' ALLOWABLE OVERDEPTH FOR DREDGING
SECTION C-C
TYPICAL SECTION - SOUTHAMPTON SHOAL CHANNEL
(NOT TO SCALE)
CENTERLINE OF CHANNEL
MATCH LINE SHEET No 3
DESCRIPTION
DATE
REVISIONS
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
CONTRA COSTA & S.F. COUNTIES
CALIFORNIA
J.F. BALDWIN SHIP CHANNEL
PHASE NO. II
SOUTHAMPTON SHOAL CHANNEL
DATE
1" = 300'
2 of 4
1
34
8



MATCH LINE - SHEET No 2
SOUTHAMPTON SHOAL CHANNEL
104+00
108+00
112+00
116+00
120+00
124+00
128+00
132+00
SHEET INDEX
1
2
3
4

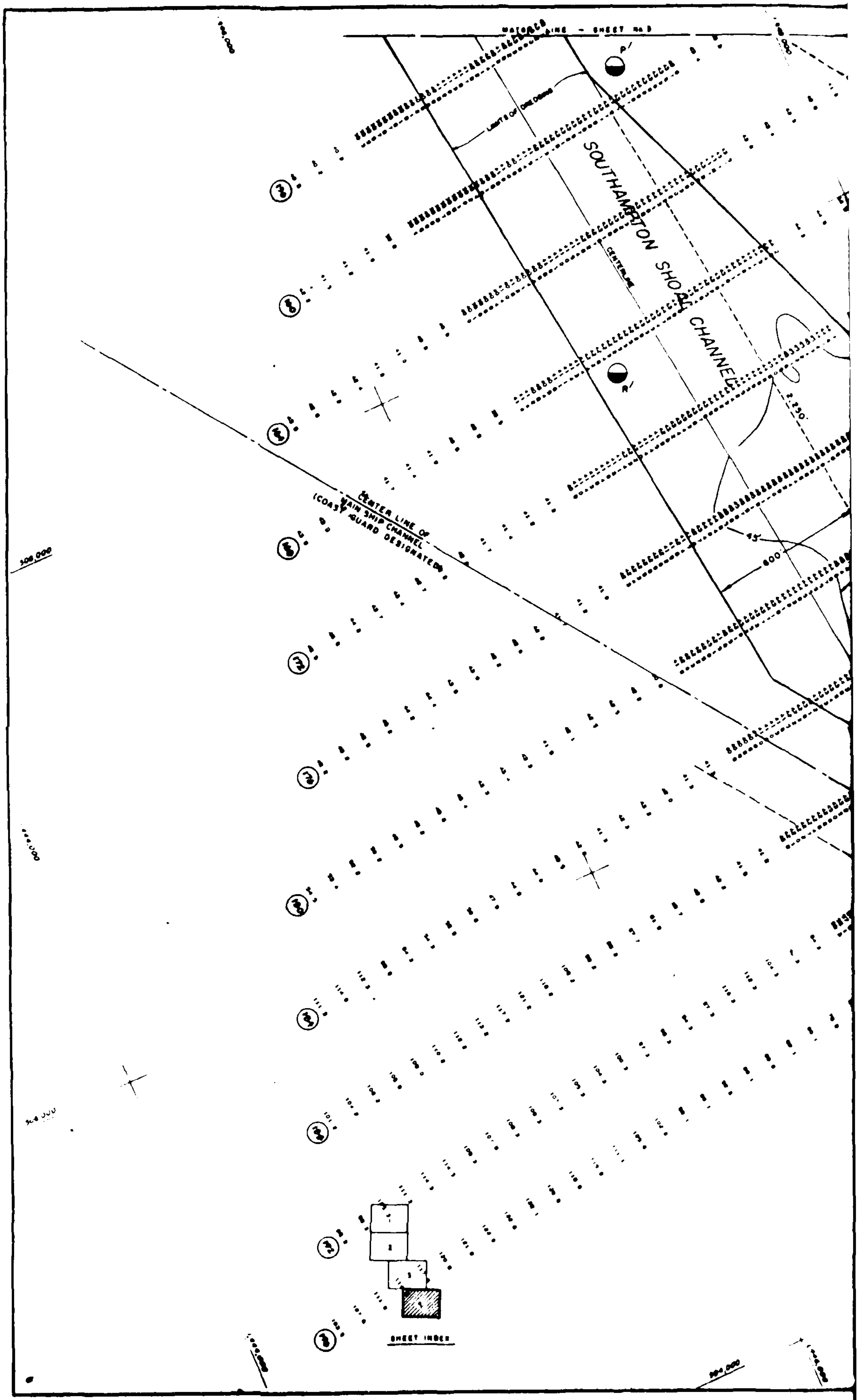
(1)


SOUTHAMPTON SHOAL CHANNEL
CENTERLINE OF CHANNEL
LIMITS OF DREDGING
BOUNDARY
SAN FRANCISCO MAIN SHIP CHANNEL
118+00
120+00
124+00
128+00
132+00
136+00
140+00
144+00
148+00
SHEET INDEX
2

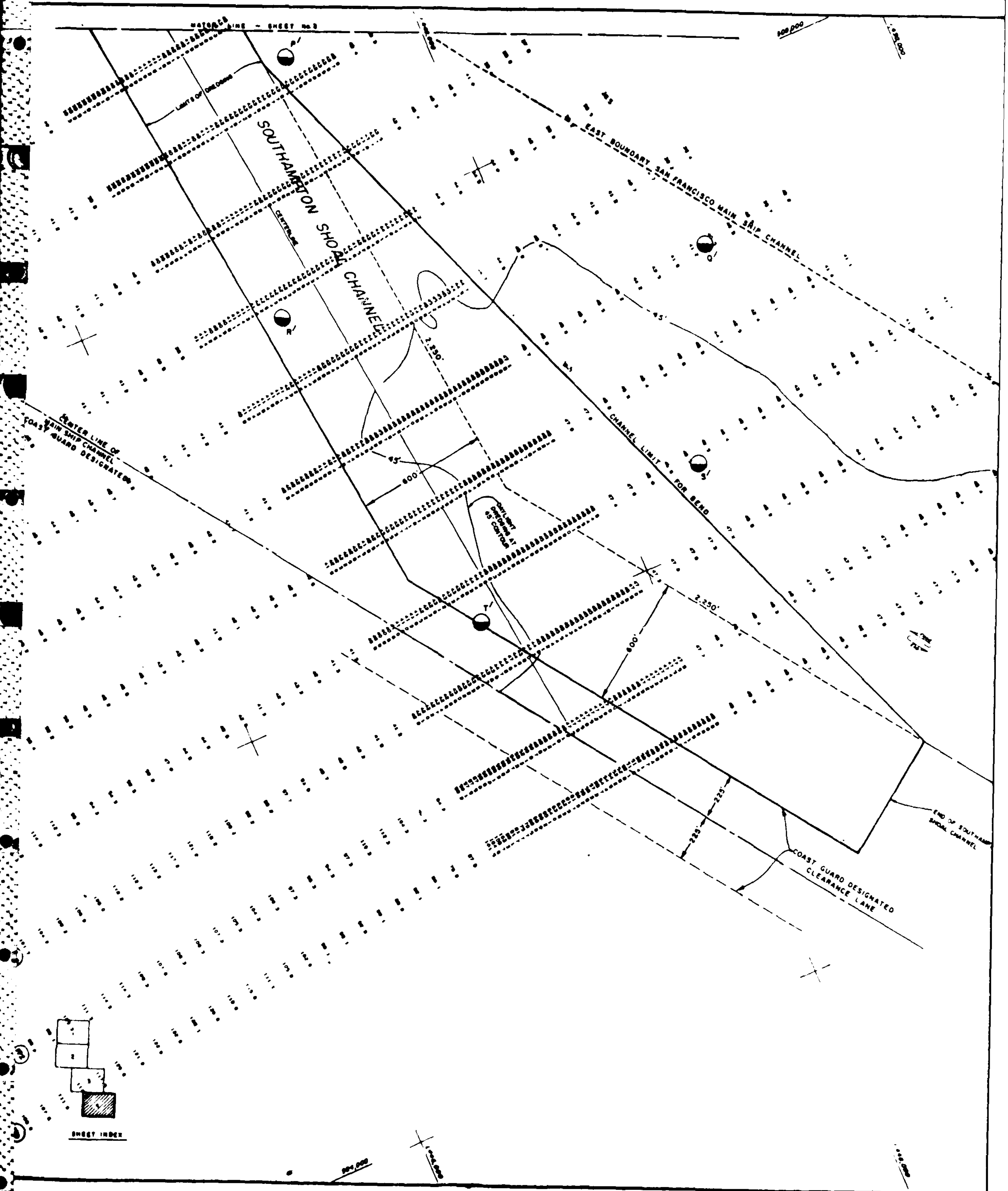


312,000
310,000
SAN FRANCISCO BAY
SHIP CHANNEL
BOUNDARY
SHEET No. 4
DESCRIPTION
REVISIONS
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
CONTRA COSTA & S F COUNTIES
CALIFORNIA
J.F. BALDWIN SHIP CHANNEL
PHASE NO. II
SOUTHAMPTON SHOAL CHANNEL
1" = 800
DRAWING NUMBER
3 of 4
1
34

3

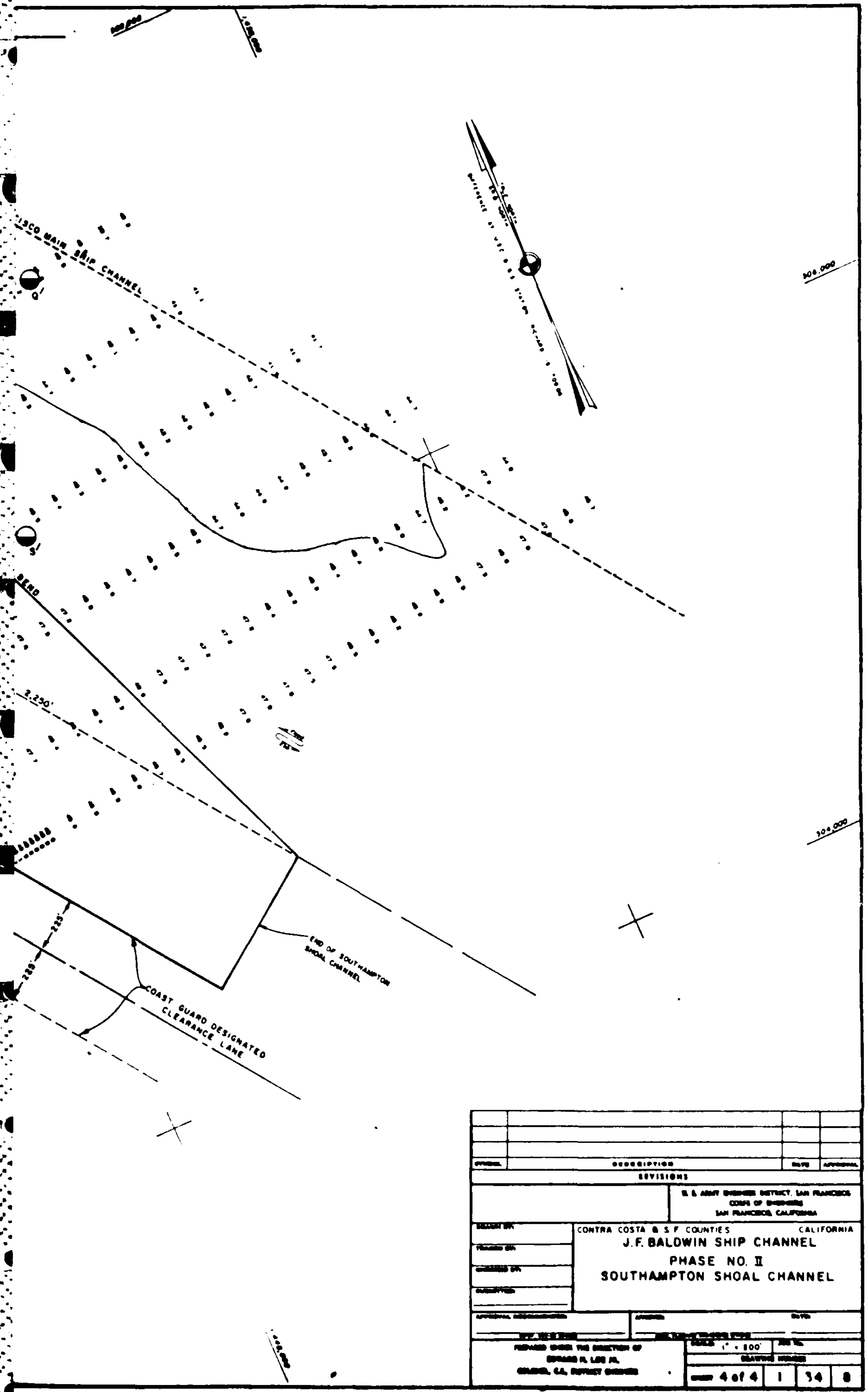


SOUTHAMPTON SHOAL CHANNEL
LIMITS OF DREDGING
CENTERLINE
CENTER LINE OF
MAIN SHIP CHANNEL
(COAST GUARD DESIGNATED)
SHEET INDEX



MATCH LINE - SHEET No. 3
SOUTHAMPTON SHOAL CHANNEL
LIMITS OF DREDGING
CENTERLINE
EAST BOUNDARY SAN FRANCISCO MAIN SHIP CHANNEL
CHANNEL LIMIT FOR BEND
CENTER LINE OF MAIN SHIP CHANNEL
COAST GUARD DESIGNATED
2,250'
600'
225'
END OF SOUTHAMPTON SHOAL CHANNEL
COAST GUARD DESIGNATED CLEARANCE LANE
SHEET INDEX

2

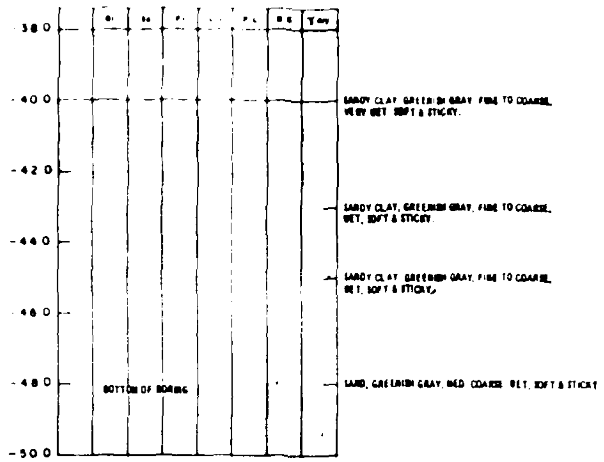


ISCO MAIN SHIP CHANNEL
BEND
2,250'
225'
225'
306,000
304,000
END OF SOUTHAMPTON SHOAL CHANNEL
COAST GUARD DESIGNATED CLEARANCE LANE
DESCRIPTION
REVISIONS
CONTRA COSTA & S F COUNTIES
CALIFORNIA
J.F. BALDWIN SHIP CHANNEL
PHASE NO. II
SOUTHAMPTON SHOAL CHANNEL
4 of 4
1
34
8

(2)

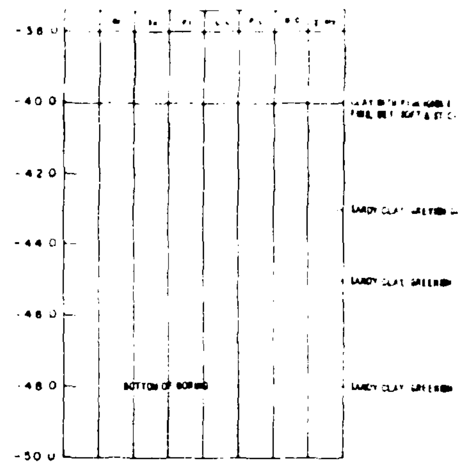
3

A



-38.0
-40.0
-42.0
-44.0
-46.0
-48.0
-50.0
BOTTOM OF BORING
SANDY CLAY, GREENISH GRAY, FINE TO COARSE, VERY WET, SOFT & STICKY.
SANDY CLAY, GREENISH GRAY, FINE TO COARSE, WET, SOFT & STICKY.
SANDY CLAY, GREENISH GRAY, FINE TO COARSE, WET, SOFT & STICKY.
SAND, GREENISH GRAY, MED. COARSE, WET, SOFT & STICKY

B



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-42.0
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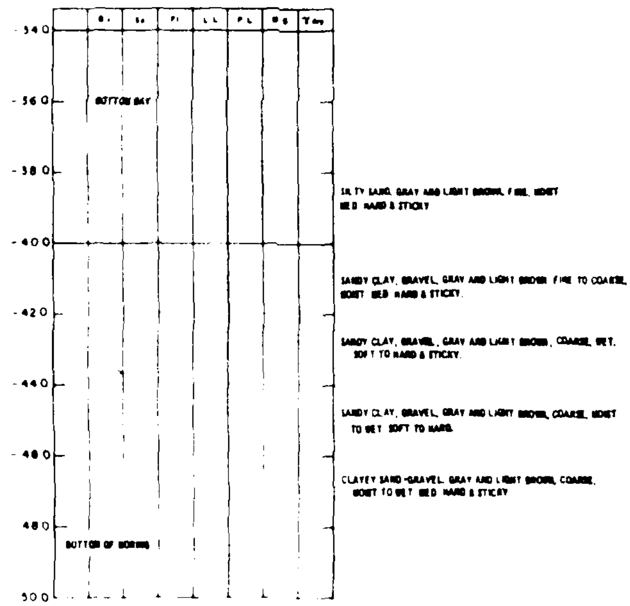
BOTTOM OF BORING

E



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-40.0
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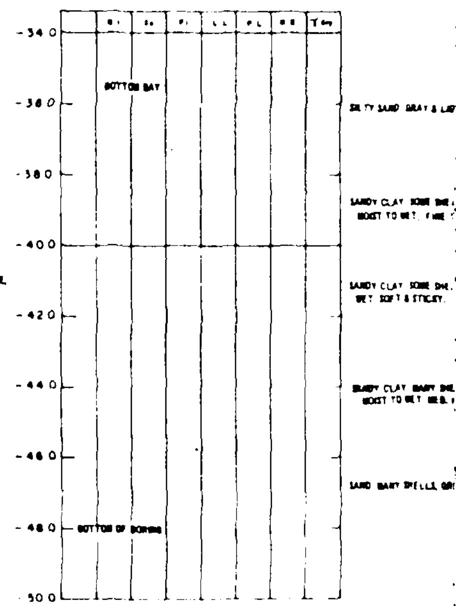
-44.0
BOTTOM BAY
BOTTOM OF BORING
SILTY SAND, GRAY AND LIGHT BROWN, FINE, MOIST, MED. HARD & STICKY
SANDY CLAY, GRAVEL, GRAY AND LIGHT BROWN, FINE TO COARSE, MOIST, MED. HARD & STICKY.
SANDY CLAY, GRAVEL, GRAY AND LIGHT BROWN, COARSE, WET, SOFT TO HARD & STICKY.
SANDY CLAY, GRAVEL, GRAY AND LIGHT BROWN, COARSE, MOIST TO WET, SOFT TO HARD.
CLAYEY SAND-GRAVEL, GRAY AND LIGHT BROWN, COARSE, MOIST TO WET, MED. HARD & STICKY

F



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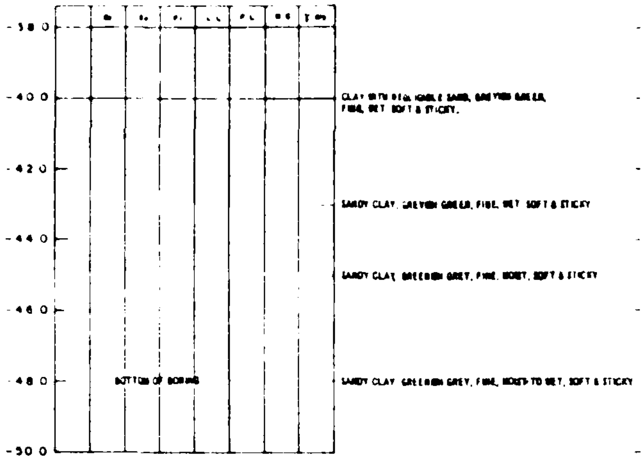
BOTTOM BAY
BOTTOM OF BORING

B



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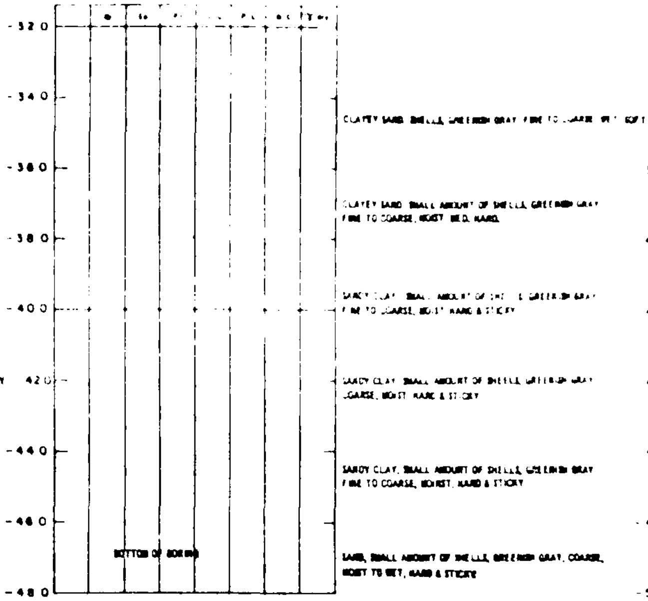
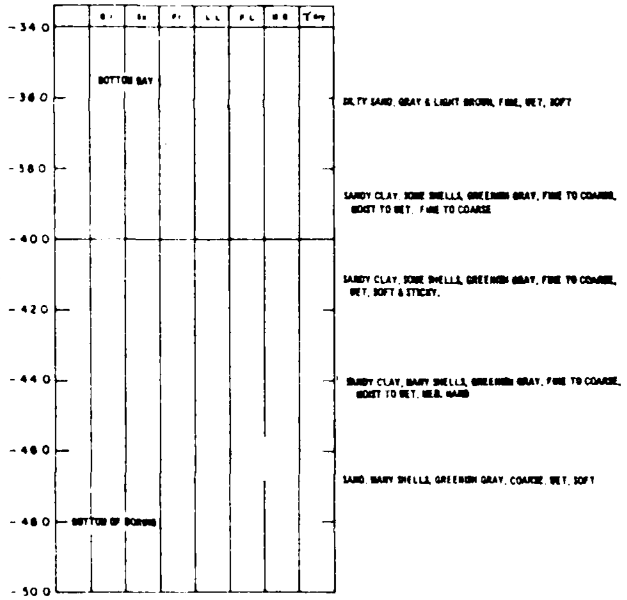
-44.0
-46.0
-48.0
-50.0
BOTTOM OF BORING
CLAY WITH NEGLIGIBLE SAND, GREYISH GREEN, FINE, WET, SOFT & STICKY.
SANDY CLAY, GREYISH GREEN, FINE, WET, SOFT & STICKY
SANDY CLAY, GREENISH GREY, FINE, MOIST, SOFT & STICKY
SANDY CLAY, GREENISH GREY, FINE, MOIST TO WET, SOFT & STICKY

C



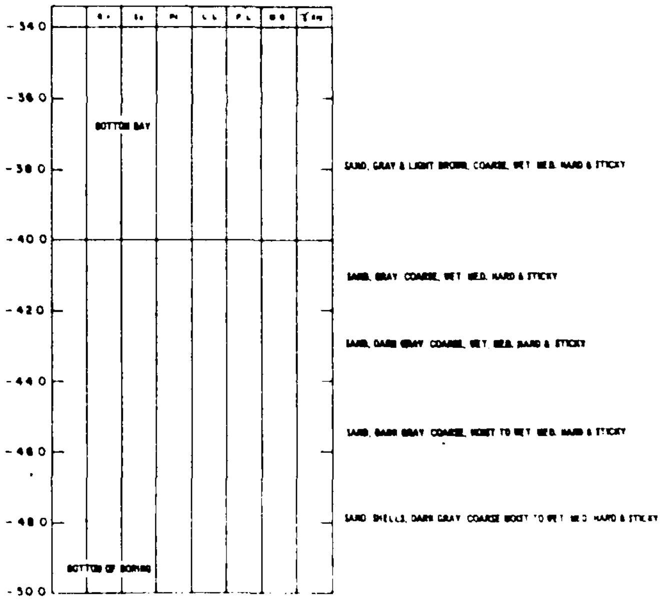
-32.0
-34.0
-36.0
-38.0
-40.0
-42.0
-44.0
-46.0
-48.0
BOTTOM OF BORING
CLAYEY SAND, SHELLS, GREENISH GRAY, FINE TO COARSE, WET, SOFT
CLAYEY SAND, SMALL AMOUNT OF SHELLS, GREENISH GRAY FINE TO COARSE, MOIST, MED. HARD
SANDY CLAY, SMALL AMOUNT OF SHELLS, GREENISH GRAY FINE TO COARSE, MOIST, HARD & STICKY
SANDY CLAY, SMALL AMOUNT OF SHELLS, GREENISH GRAY COARSE, MOIST, HARD & STICKY
SANDY CLAY, SMALL AMOUNT OF SHELLS, GREENISH GRAY FINE TO COARSE, MOIST, HARD & STICKY
SAND, SMALL AMOUNT OF SHELLS, GREENISH GRAY, COARSE, MOIST TO WET, HARD & STICKY

F



-34.0
-36.0
-38.0
-40.0
-42.0
-44.0
-46.0
-48.0
-50.0
BOTTOM BAY
BOTTOM OF BORING
SILTY SAND, GRAY & LIGHT BROWN, FINE, WET, SOFT
SANDY CLAY, SOME SHELLS, GREENISH GRAY, FINE TO COARSE, MOIST TO WET, FINE TO COARSE
SANDY CLAY, SOME SHELLS, GREENISH GRAY, FINE TO COARSE, WET, SOFT & STICKY.
SANDY CLAY, MANY SHELLS, GREENISH GRAY, FINE TO COARSE, MOIST TO WET, MED. HARD
SAND, MANY SHELLS, GREENISH GRAY, COARSE, WET, SOFT

G



-34.0
-36.0
-38.0
-40.0
-42.0
-44.0
-46.0
-48.0
-50.0
BOTTOM BAY
BOTTOM OF BORING
SAND, GRAY & LIGHT BROWN, COARSE, WET, MED. HARD & STICKY
SAND, GRAY, COARSE, WET, MED. HARD & STICKY
SAND, DARK GRAY, COARSE, WET, MED. HARD & STICKY
SAND, DARK GRAY, COARSE, MOIST TO WET, MED. HARD & STICKY
SAND, SHELLS, DARK GRAY, COARSE, MOIST TO WET, MED. HARD & STICKY

D

-34.0

-36.0

CLAYEY SAND, SHELLS, GREENISH GRAY, FINE TO COARSE, WET, SOFT.

-38.0

CLAYEY SAND, SMALL AMOUNT OF SHELLS, GREENISH GRAY, FINE TO COARSE, MOIST, MED. HARD.

-40.0

SANDY CLAY, SMALL AMOUNT OF SHELLS, GREENISH GRAY FINE TO COARSE, MOIST, HARD & STICKY

-42.0

SANDY CLAY, SMALL AMOUNT OF SHELLS, GREENISH GRAY, COARSE, MOIST, HARD & STICKY

-44.0

-46.0

SANDY CLAY, SMALL AMOUNT OF SHELLS, GREENISH GRAY, FINE TO COARSE, MOIST, HARD & STICKY.

-48.0

SAND, SMALL AMOUNT OF SHELLS, GREENISH GRAY, COARSE, MOIST TO WET, HARD & STICKY

-50.0

SANDY CLAY, SHELLS, GRAYISH GREEN, FINE, WET, MED. HARD & STICKY

SANDY CLAY, SHELLS & WOOD, GRAYISH GREEN, FINE, WET, MED. HARD & STICKY.

SANDY CLAY, SHELLS, GRAYISH GREEN, FINE TO COARSE, MOIST TO WET, MED. HARD & STICKY

SANDY CLAY, SHELLS, GRAYISH GREEN, FINE TO COARSE, WET, SOFT & STICKY.

SANDY CLAY, SHELLS, GRAYISH GREEN, FINE TO COARSE, WET, SOFT & STICKY.

BOTTOM OF BORING

SANDY CLAY, SHELLS, GRAYISH GREEN, FINE TO COARSE, WET, SOFT & STICKY.

SAND, GRAY & LIGHT BROWN, COARSE, WET, MED. HARD & STICKY.

SAND, GRAY, COARSE, WET, MED. HARD & STICKY.

SAND, DARK GRAY, COARSE, WET, MED. HARD & STICKY.

SAND, DARK GRAY, COARSE, MOIST TO WET, MED. HARD & STICKY

SAND, SHELLS, DARK GRAY, COARSE MOIST TO WET, MED. HARD & STICKY.

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY
TRACED BY
CHECKED BY
SUBMITTED

CONTRA COSTA & S.F. COUNTIES CALIFORNIA

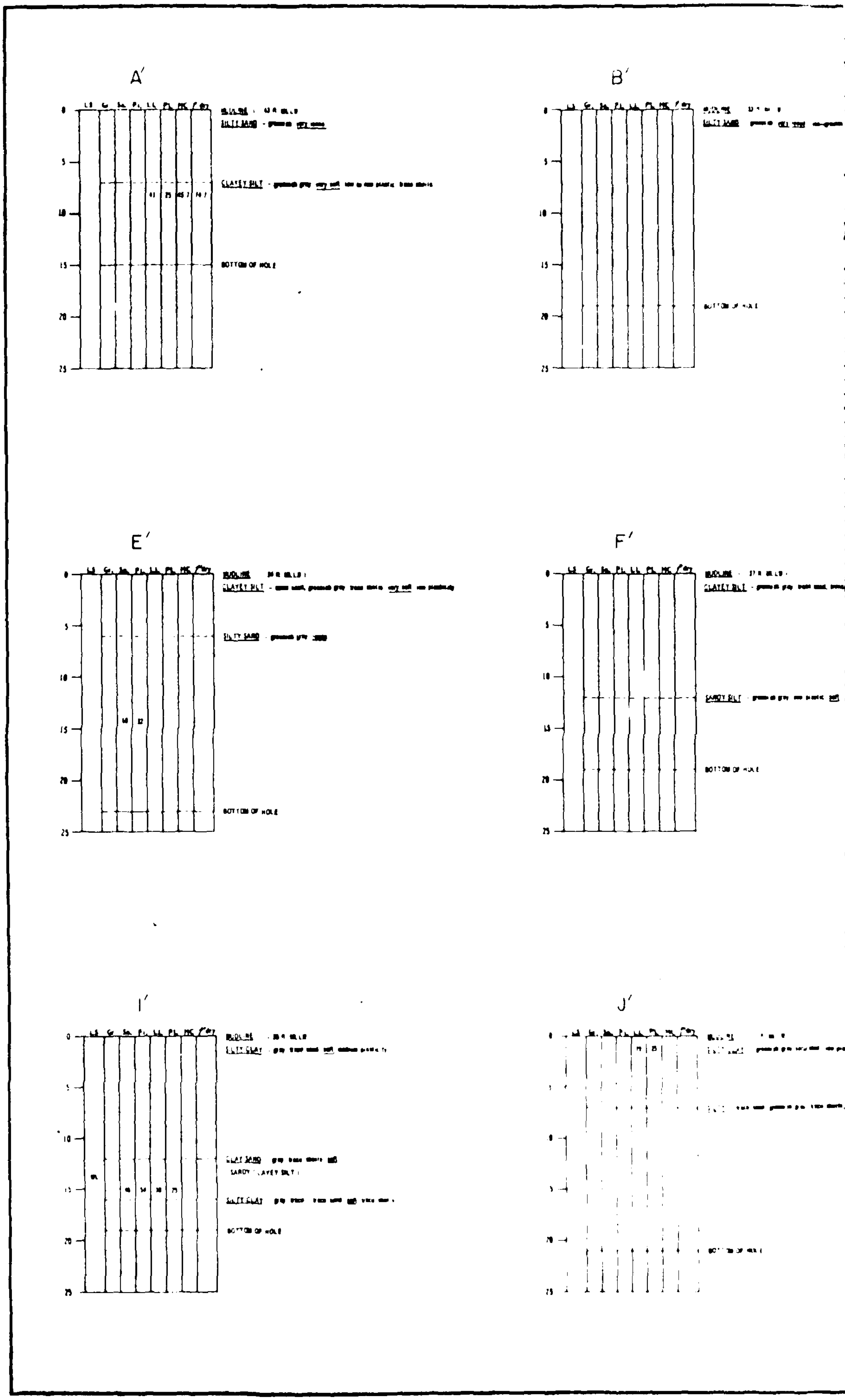
J. F. BALDWIN SHIP CHANNEL
PHASE NO. II
LOGS OF EXPLORATION HOLES
RICHMOND LONGWHARF MANEUV. AREA

APPROVAL RECOMMENDED
APPROVED
DATE

PREPARED UNDER THE DIRECTION OF
EDWARD R. LEE, JR.
COLONEL, C.E., DISTRICT ENGINEER

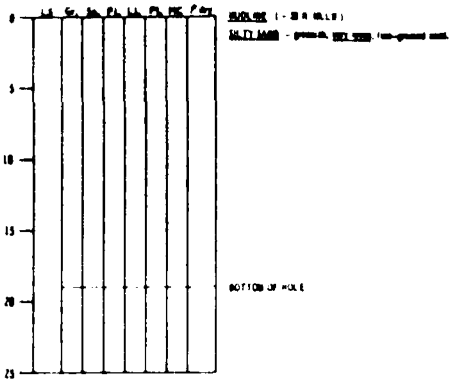
SCALE
DRAWING NUMBER
SHEET 1 | 1 | 5 | 10

3



A′
CLAYEY SILT
BOTTOM OF HOLE
B′
BOTTOM OF HOLE
E′
CLAYEY SILT
SILTY SAND
BOTTOM OF HOLE
F′
CLAYEY SILT
SANDY SILT
BOTTOM OF HOLE
I′
SILTY CLAY
BOTTOM OF HOLE
J′
BOTTOM OF HOLE

B′



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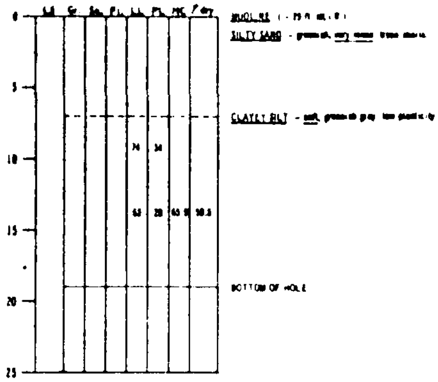

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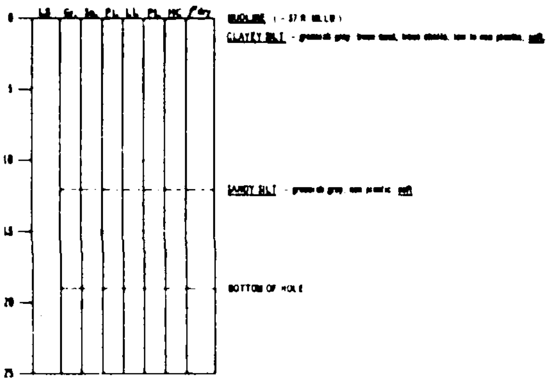

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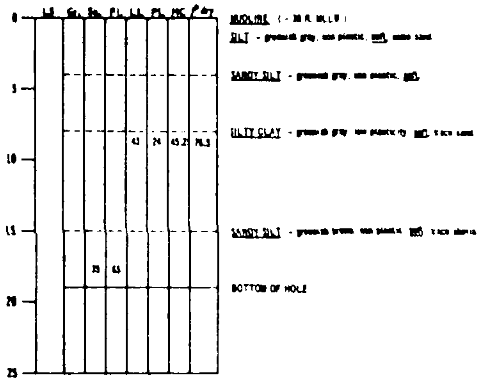

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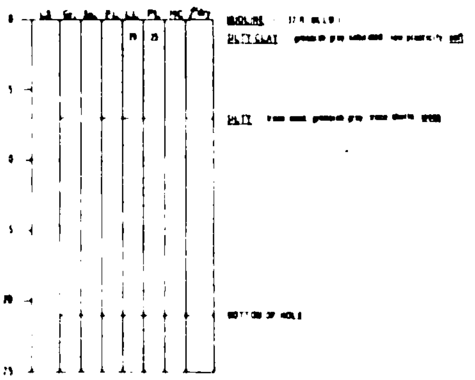

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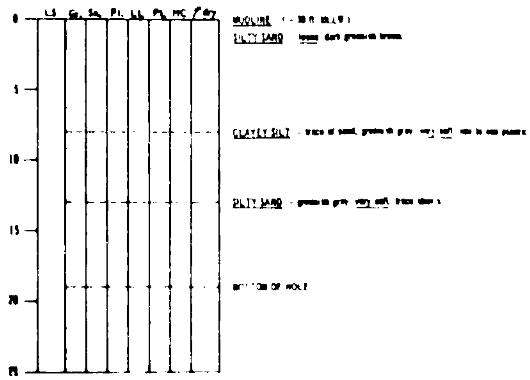
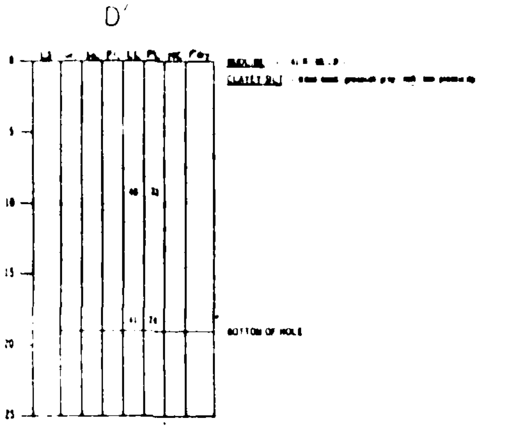
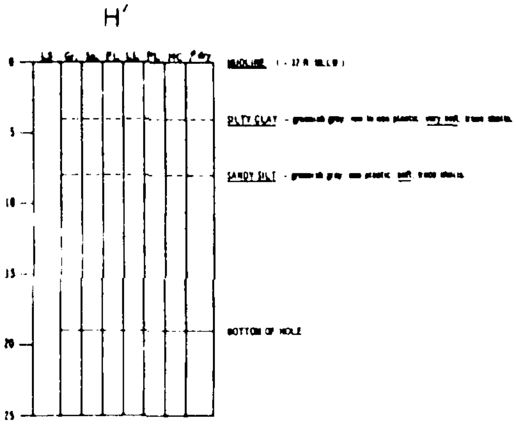


LEGEND

LS LABORATORY CLASSIFICATION
Gr. Percent Gravel
Sa. Percent Sand
Fi. Percent Fines
LL LIQUID LIMIT
PL PLASTIC LIMIT
MC FIELD MOISTURE CONTENT
γdry FIELD DRY UNIT WEIGHT
A BORING IDENTIFICATION





NOTES

1. BORINGS TAKEN BETWEEN 21 DEC. 83 AND 4 JAN 84
2. ELEVATIONS BASED ON HYDRO - SURVEY TAKEN 16 & 17 FEB 1984 BY TOWILL, INC.
3. DATUM OF MEAN LOWER LOW WATER (MLLW) TIDE GAGE AT PARR TERMINAL DOCK REFERENCED TO U.S.C. & G.S B.M. NO. 4 (1934) PT. RICHMOND, CALIFORNIA, ELEVATION 46.13 FT. ABOVE MLLW

LEGEND

- LS LABORATORY CLASSIFICATION
- Gr Percent Gravel
- Sa Percent Sand
- Fi Percent Fines
- LL LIQUID LIMIT
- PL PLASTIC LIMIT
- MC FIELD MOISTURE CONTENT
- γ_{dry} FIELD DRY UNIT WEIGHT
- A′ BORING IDENTIFICATION SOUTHAMPTON SHOAL

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

CONTRA COSTA & S.F. COUNTIES — CALIFORNIA

J.F. BALDWIN SHIP CHANNEL
LOG OF EXPLORATION HOLES
RICHMOND SOUTHAMPTON SHOAL CHANNEL

DRAWN BY / TRACED BY / CHECKED BY / SUBMITTED BY

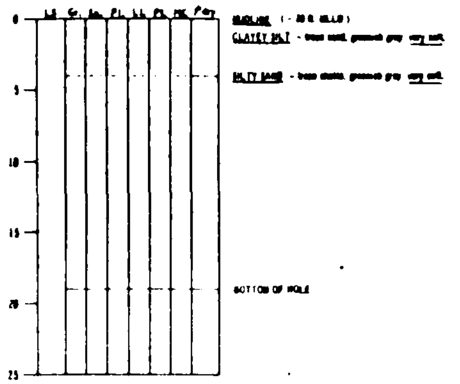
APPROVAL RECOMMENDED / APPROVED / DATE

PREPARED UNDER THE DIRECTION OF
EDWARD M. LEE, JR.
COLONEL, C.E., DISTRICT ENGINEER

SCALE / DRAWING NUMBER

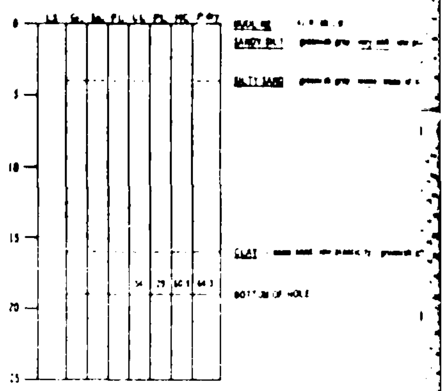
SHEET 2 | 1 | 5 | 10

L′



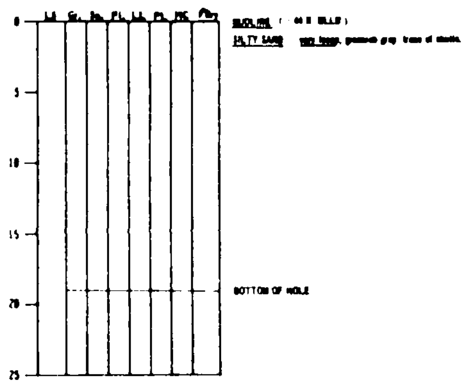
CLAYEY SILT
SILTY SAND
BOTTOM OF HOLE

M′



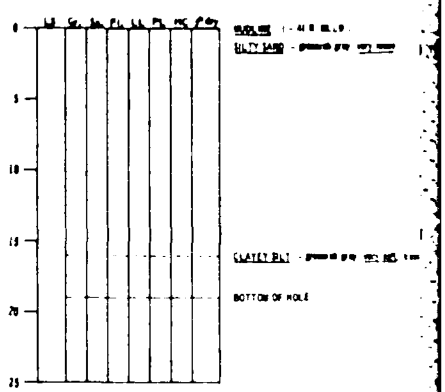
SANDY SILT
SILTY SAND
CLAY
BOTTOM OF HOLE

P′



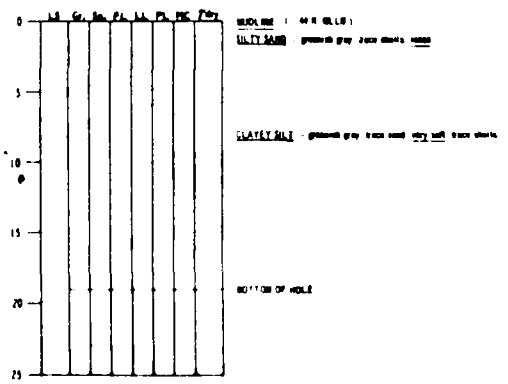
SILTY SAND
BOTTOM OF HOLE

Q′



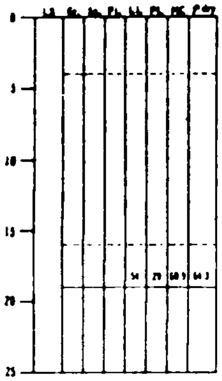
SILTY SAND
CLAYEY SILT
BOTTOM OF HOLE

T′



SILTY SAND
CLAYEY SILT
BOTTOM OF HOLE

M′



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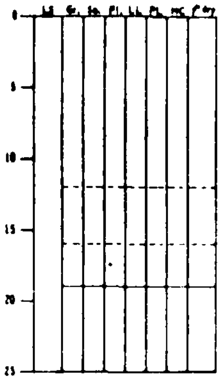

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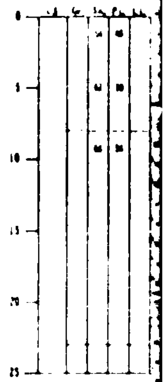

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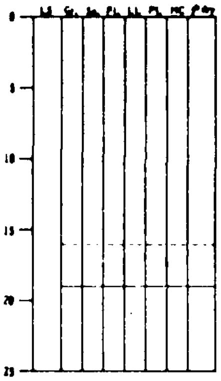

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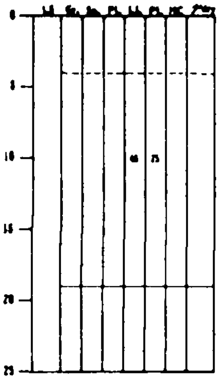

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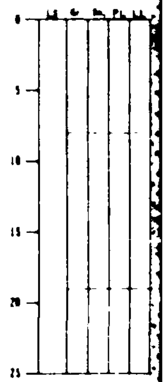
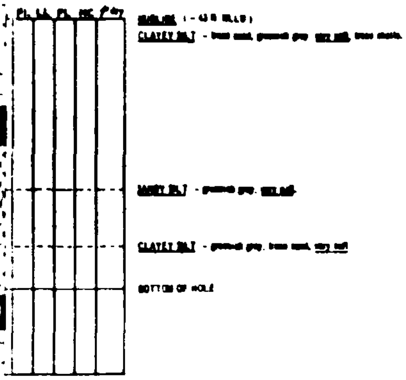


DRAWN BY
TRACED BY
CHECKED BY
COLONEL, C.E.

7

N′



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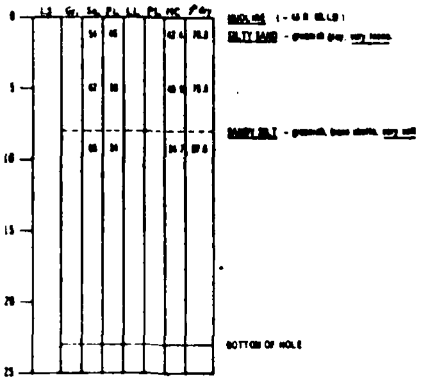

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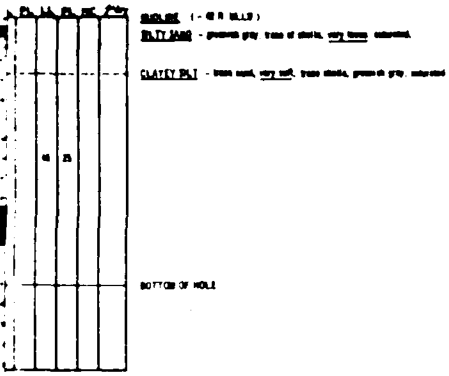

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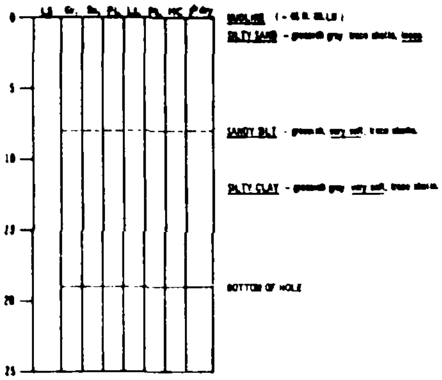


SYMBOL | DESCRIPTION | DATE | APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

CONTRA COSTA & S.F. COUNTIES — CALIFORNIA

JF BALDWIN SHIP CHANNEL
LOG OF EXPLORATION HOLES
RICHMOND SOUTHAMPTON SHOAL CHANNEL

DRAWING NUMBER

SHEET 3 | 1 | 5 | 10

APPENDIX E
CULTURAL RESOURCES

This appendix consists of Cultural Resources Section taken from Appendix F of the Richmond Harbor Feasibility Report, 1981. A new cultural resources survey was not conducted for the subject study as the Richmond Harbor survey included the Richmond Long Wharf area. In addition none of the final action alternatives discussed in the subject study will affect land areas and the aquatic areas impacted are located in deep water with swift currents.

CULTURAL RESOURCES

CULTURAL RECONNAISSANGE

1.13 A thorough literature search was performed for the area which included, but was not limited to, examination of maps, records and scholarly publications on file at the District 01 Clearinghouse, Department of Anthropology, California State University at Sonoma, State Department of Parks and Recreation, University of California in Berkeley; Richmond Main Library, Historical Section, Richmond Museum and the Contra Costa Historical Society.

1.14 Aerial photos of the Richmond Harbor taken by the Corps in May 1963 were analyzed for possible identification of areal cultural resources. There was no indication of terrestrial or submerged cultural resources within or immediately adjacent to the project area. Mrs. Ethel Kerns, President of the Richmond Museum Society and long-term resident of Richmond was contacted in person at the museum on 14 October 1976, and it was her determination that no cultural resources exist within or immediately adjacent to the proposed project area.

1.15 Mr. L. Stein of the Contra Costa Historical Society was contacted in person on 14 October 1976, and it was his determination that no known cultural resources or items of historical interest currently exist within or immediately adjacent to the proposed project area.

1.16 <u>The Preliminary Historic Resources Inventory, Contra Costa County, California 1976</u> was consulted and no previously unmentioned registered sites of historic resources occurred within or adjacent to the project area.

DESCRIPTION OF KNOW SITES IN GENERAL STUDY AREA

1.17 Several significant archaeological sites have been identified in the near vicinity of the proposed project area. Research substantiates proto-historic and prehistoric Native American habitation of the area and reflects the interesting geologic history of the San Francisco Bay. Many of the known sites are partially submerged below bay waters, but retain substantial site integrity and research potential.

1.18 One such site, the Ellis Landing Site (CA-CCO-295), exists immediately adjacent to the proposed project area and consisted of an elliptical shaped habitation midden which, prior to extensive historic disturbance, may have measured approximately 460 feet in diameter at the base along a northwest-southeast axis, by 245 feet in width, by 33 feet in height; 17 feet extended vertically above marsh level and 16 feet extended below marsh level. Utilizing a Danish formula, the estimated age of the midden is roughly 3,500 years. Although the ethnographic record fails to document Coastanoan midden habitation or territorial occupation for the entire period represented by the midden, it is reasonable to assume that at least the uppermost levels of the midden may have been attributable to Coastanoan habitation. The contemporary average depth of water between Brooks Island and the Parr-Richmond Terminal No. 3 General Cargo Wharf (Benchmark 13 on U.S.G.S. Richmond Quadrangle) is 2 feet.

1.19 Historically, Ellis Landing was located immediately adjacent to the project area near the current site of the Parr Oil Dock. The landing was a 19th century commercial enterprise begun by Mr. George Ellis and consisted of a wharf, warehouse and residential structure. All improvements were completely destroyed circa 1929-30 prior to construction of the Richmond Harbor facilities. The area was subsequently elevated using landfill borrowed from Easter Hill in Richmond. No other structures or known cultural resources exist within, or adjacent to, either of the proposed project areas. The Ellis Landing Site was extensively damaged due to construction activities and landfill shortly after the beginning of the 20th century.

1.20 Several prehistoric sites have been identified on Brooks Island to the south of Ellis Landing. One such site is partially submerged under Bay waters, but the parameters of the site do not extend sufficient distance to be impacted by either of the proposed project alternatives.

1.21 The Ellis Landing Site and the Brooks Island sites are located on a shallow alluvial terrace which runs on a north-south axis decreasing in elevation to the west toward Southampton Shoal. On the basis of recent geologic data and calculation of early Holocene sea-level changes, it is likely that the greater portion of the alluvial terrace was above sea level circa 8,000 B.C. and accessible by foot from the present shoreline approximately 2 miles to the west. As the rate of increase in Holocene sea-level declined, the rate of natural sedimentation increased resulting in the accumulation of Younger Bay Mud. The siltation process was greatly accelerated in the late 19th century as a result of hydraulic mining activites in the Sierra-Nevada foothills to the east.

ASSESSMENT OF RECONNAISSANCE

1.22 No cultural resources are known to exist within the proposed project area and it is considered improbable that the recommended harbor improvements in the form of deepening the existing channel would encounter submerged resources. Waterborne traffic and annual maintenance dredging of the channel since construction in 1932 have severely disturbed channel sediments. The proposed dredge depth is -41 feet MLLW. Soundings and pollution samples taken from within the channel in August 1976 indicate that significant portions of the existing channel are currently maintained to a depth approximately -35 feet MLLW, with an allowable two feet overdepth. Analysis of sediment samples taken from the Richmond Harbor Entrance Channel indicates that dredged materials below -35 feet MLLW consist of disturbed Younger Bay Mud. Analysis of sediment samples secured from the Potrero Point Reach, Potrero Point Turn and Harbor Channel indicate that materials dredged to the recommended depth would consist of more consolidated deposits of Older Bay Mud.

1.23 Based on the above data, the channel bottom area with the greatest potential for submerged cultural resources is the Richmond Harbor Entrance Channel. The Holocene sediments in this reach have been severely disturbed to the extent that site integrity and research potential would be minimal. Because of these factors no program of sediment sampling or monitoring of dredge materials is anticipated for existing channel reaches at this time.

1.24 The creation of a turning basin shall result in the disturbance and relocation of a significant portion of previously undisturbed Bay sediment. Although no substantive evidence exists documenting the presence of submerged cultural resources, the geologic and archaeologic records indicate that the area is archaeologically "sensitive," or has a high potential as a source of archeological material. Should the review of core samples of sediments in the proposed turning basin indicate the presence of submerged cultural resources, further testing and analysis of the channel bottom area would be considered on the basis of the data.

1.25 The Ellis Landing Site (CA-CCO-295) which is located immediately adjacent to the project area shall not be adversely impacted, either directly or indirectly, by the proposed project.

1.26 The Brooks Island sites which are located outside the project area shall not be adversely impacted, either directly or indirectly, by the proposed project. It is likely that the dredging activities within the project area shall generate increased particulate suspension and accelerate sediment accumulation in the area of the sites. This is not considered to be either an adverse or beneficial impact. The channel deepening shall not result in unstable sidewalls which might slump and endanger site integrity in the Brooks Island area.

1.27 There shall be no adverse primary or secondary impacts on submerged cultural resources within the proposed dredge disposal area. The aquatic disposal of dredged materials at the Alcatrz and/or 100-fathom sites poses no threat to cultural resources because the site has been used as a disposal site for dredged materials since the 1930's and is subject to heavy underwater scouring due to tidal action.

CONCLUSIONS

1.28 In compliance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470(f)), and Executive Order 11593, of 13 May 1971, the following actions have been taken:

A. The most recent listing of the National Register of Historic Places (with monthly supplements up to and including 3 February 1981) has been consulted with the result that no properties listed in, or eligible for listing in, the National Register of Historic Places, were found to be within or adjacent to the project area (including disposal sites).

B. Request has been made of the State Office of Historic Preservation for information concerning any areal cultural resources which could be impacted by the proposed project.

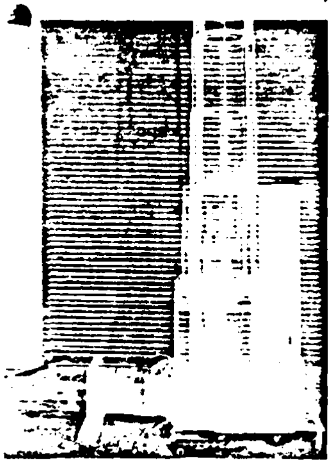
C. A literature search was conducted at the Regional Office of the California Archaeological Site Survey, Sonoma State University, Rohnert Park, California, with the result that archaeological sites have been located in the vicinity of, but not within, the project area. The archaeological sites consist of CA-CCO-295 and the Stege Mounds (CA-CCO-297, 298, 299, and 300) on the mainland, and several prehistoric sites on Brooks Island.

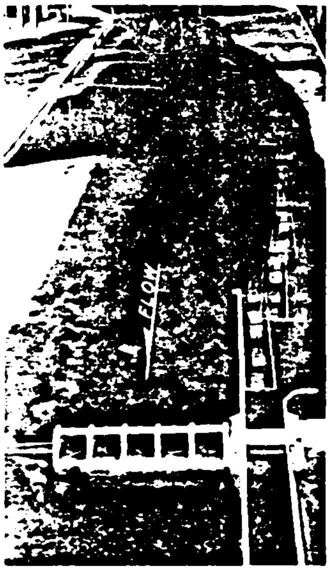
1.29 It is the Corps' determination that there is little or no potential for the existence of significant cultural resources within the project area. This determination is based upon the fact that the dredging and disposal areas which comprise the project area are entirely submerged beneath the waters of San Francisco Bay. Should archaeological sites have existed within the project area (prior to submergence by rising bay waters) it is likely that they would have lost their integrity and research potential as a result of the horizontal fluctuation of bottom sediments caused by man-made and/or natural currents. In addition, most of the project area has been disturbed by either previous dredging or disposal. The Richmond Harbor Channel, and the Southampton Shoal Channel have both been dredged to depths ranging from -35 to -37 feet below MLLW. A large section of the New Turning Basin was previously dredged to create the Old Ford Channel. The disposal area off Alcatraz has been used for dredged materials since the 1930's.

1.30 All archaeological sites refered to, with the exception of one, are located entirely on uplands and will be neither directly nor indirectly affected by the proposed project. One archaeological site, located on Brooks Island, extends below Mean Higher High Water, although no portion of the site extends into the area to be dredged. Dredging would not affect the partially submerged archaeological site in that: (1) No portion of the site would be excavated by dredging, and (2) the dredge would not create waves or currents which would impact the site.

APPENDIX F
NAVIGATION SIMULATION STUDY

US Army Corps of Engineers





HYDRAULICS LABORATORY

TECHNICAL REPORT HL-84-

SHIP SIMULATION STUDY OF JOHN F. BALDWIN (PHASE II) NAVIGATION CHANNEL, SAN FRANCISCO BAY, CALIFORNIA

by

Carl Huval, Bradley Comes, Robert T. Garner III

Hydraulics Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

April 1984
Final Report

Prepared for U. S. Army Engineer District, San Francisco
San Francisco, Calif. 94105

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

Field	Entry
1. REPORT NUMBER	Technical Report HL-84-
2. GOVT ACCESSION NO.	
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle)	SHIP SIMULATION STUDY OF JOHN F. BALDWIN (PHASE II) NAVIGATION CHANNEL, SAN FRANCISCO BAY, CALIFORNIA
5. TYPE OF REPORT & PERIOD COVERED	Final report
6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s)	Carl Huval Bradley Comes Robert T. Garner III
8. CONTRACT OR GRANT NUMBER(s)	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	U. S. Army Engineer Waterways Experiment Station Hydraulics Laboratory P. O. Box 631, Vicksburg, Miss. 39180
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
11. CONTROLLING OFFICE NAME AND ADDRESS	U. S. Army Engineer District, San Francisco 211 Main Street San Francisco, Calif. 94105
12. REPORT DATE	April 1984
13. NUMBER OF PAGES	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	
15. SECURITY CLASS (of this report)	Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Available from National Technical Information Service, 5285 Port Royal Road, Springfield, Va. 22161

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The WES Research Ship Simulator was used to evaluate the design of Phase II of the John F. Baldwin Ship Channel and to study the impact of the deepened channel on the navigability of large tankers inbound to the Long Wharf docking facility near Richmond Harbor. The present channel and maneuvering area is dredged to 35 ft deep and is inadequate for the larger tankers bringing crude oil from the Alaskan North Slope. The San Francisco District

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20. ABSTRACT (Continued)

has proposed to dredge the channel to 45 ft deep. The authorized 35-ft-deep channel was simulated to verify the simulator setup as well as establish the base maneuvering strategies, and the proposed 45-ft-deep channel was simulated to study the proposed conditions. In addition to the tankers, containerships navigating into Richmond Harbor entrance channel were also simulated to investigate the impact of channel deepening on other ships using the maneuvering area.

The proposed project will allow fully laden 87,000-dwt and partially laden 150,000-dwt tankers to unload at the Long Wharf. Present tanker operations require all but the smallest tankers to anchor in the main bay and off-load a substantial part of the cargo into shallower draft tankers that can be accommodated with the 35-ft-deep channel. The design channel will reduce transportation costs as well as reduce the possibility of oil spills in San Francisco Bay.

As a part of the project, a reconnaissance trip was made to observe ship and pilot operations and to record the inbound trip into the Long Wharf maneuvering area on a typical tanker presently using the channel. The channel geometry, the overbank depths, and the visual scene were then developed for the simulator using maps and photographs of the project area. All important visual information was included so as to provide the proper visual cues to the pilot conning the ship. Special tests were conducted on the San Francisco Bay-Delta Model to gather realistic tide current data for input into the ship simulator. All simulations were run with a 20-knot wind blowing from the southwest.

Tests for the base and design channel conditions were conducted using 87,000-dwt partially laden (30-ft draft) and 150,000-dwt partially laden (40-ft draft) tankers, respectively. Both flood and ebb current tide conditions were simulated. In addition to ship track plots, several other critical parameters were plotted and studied, such as ship speed and docking posture as it approaches the Long Wharf. The main containership used to simulate future size ships calling at Richmond Harbor was 810 ft long and 106-ft beam loaded to a 32-ft draft. A smaller containership with 638-ft length and 100-ft beam was also used to simulate present-day ship sizes.

Test results indicated that it is very important to reduce tanker speed to about 5 knots before starting the large right turn into the maneuvering area. Acceptable docking postures can be achieved for both channel conditions under both ebb and flood tide so as to allow safe tanker docking into Long Wharf. The containership tests indicated that it is reasonably safe to maneuver around the point and line up with the Richmond Harbor entrance channel on flood tide. Ebb tide conditions require very careful control of ship speed and position to execute a safe turn in the maneuvering area when piloting the 810-ft containership. The 638-ft containership was much easier to maneuver around the point.

PREFACE

This investigation was performed by the Hydraulics Laboratory of the U. S. Army Engineer Waterways Experiment Station (WES) for the U. S. Army Engineer District, San Francisco (SPN). The study was conducted with the WES research ship simulator. Authority for the investigation was given by SPN in SPNPE-TE letter of 20 May 1983. SPN provided the essential field and model data required. The study was conducted during the period June 1983-March 1984. The main study results were presented at a general design/checkpoint conference at San Francisco on 19 January 1984 and repeated at the project public meeting on 16 February 1984.

The investigation was conducted by Messrs. Carl Huval, Bradley Comes, and Robert T. Garner III of the Mathematical Modeling Group, under the general supervision of Messrs. H. B. Simmons, Chief of the Hydraulics Laboratory, and M. B. Boyd, Chief of the Hydraulic Analysis Division.

Acknowledgment is made to Messrs. Jay Soper and Rod Chisholm, Planning/Engineering Division, SPN, for their cooperation and assistance at various times throughout the investigation. Special thanks should go to the tanker operations officials and pilots of the Chevron Richmond Refinery for access to an inbound tanker into Long Wharf and for furnishing a professional pilot to conduct ship simulator tests on the WES simulator.

Commander and Director of WES during the conduct of this investigation and the preparation and publication of this report was COL Tilford C. Creel, CE. Technical Director was Mr. F. R. Brown.

CONTENTS

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
feet	0.3048	metres
feet per second	0.3048	metres per second
knots (international)	0.514444	metres per second
miles (U. S. statute)	1.609344	kilometres

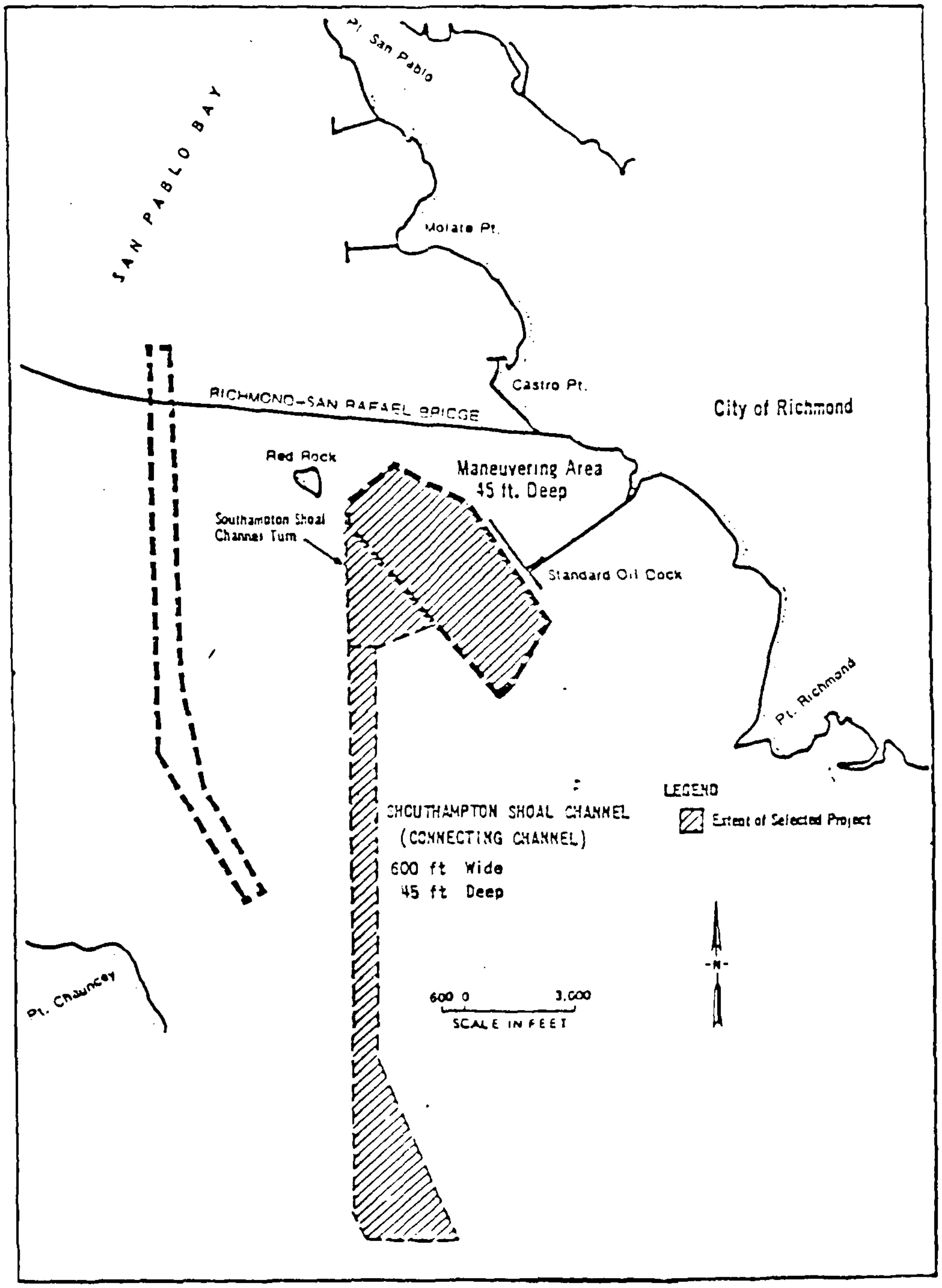

Figure 1. Study area

SHIP SIMULATION STUDY OF JOHN F. BALDWIN (PHASE II) NAVIGATION CHANNEL, SAN FRANCISCO BAY, CALIFORNIA

PART I: INTRODUCTION

1. The Central San Francisco Bay Segment of the John F. Baldwin Ship Channel (Phase II) Project consists of the Richmond Long Wharf maneuvering area and the 1.1-mile*-long Southampton Shoal Channel, both located west of Richmond, California. The purpose of the project is to provide a direct and safe route for large tankers transporting crude petroleum stocks to the Richmond Long Wharf loading-unloading facility. The existing channel available to the tankers (Southampton Shoal and the Long Wharf maneuvering area, Figure 1) has an authorized depth of 35 ft mean lower low water (mllw). This restriction requires many of the more modern tankers with larger capacities and deeper drafts to be lightered or to wait for a high tide in order to use the channel. Both of these operational alternatives have economic and environmental costs as follows:

- a. Waiting for the proper tide conditions in combination with the required lightering time increases the operating costs of the refinery facility and decreases the number of tankers that can call at the Richmond Long Wharf.
- b. The off-loading of crude oil while anchored in San Francisco Bay increases the possibility of an oil spill.

2. The U. S. Army Engineer District, San Francisco (SPN), has proposed to dredge the existing channel and maneuvering area to a depth of 45 ft mllw. The District Office has asked the U. S. Army Engineer Waterways Experiment Station (WES) to conduct a study using the ship simulator facility to answer several questions with respect to navigation of vessels in the proposed channel. The following questions were investigated as part of the study on the WES ship simulator:

- a. Is it possible for the large 150-kdwt tankers loaded to 40-ft draft to make the required maneuver from the north end of Southampton Shoal Channel into a proper docking posture at the Richmond Long Wharf?

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* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 3.

_. What possible changes in the geometry of the channel or the maneuvering area should be made to improve safety in the area with respect to navigation?

c. Would the proposed project require any new or unexpected maneuvering strategies that should be brought to the vessel pilot's attention?

d. Would dredging the channel and the maneuvering area affect the maneuverability of any existing vessels, i.e. containerships, using the study area en route to Richmond Harbor?

3. The channel scenario documentation, simulator methodology, and test results for this study are presented in the following report.

PART II: THE SCENARIO SETUP

4. Two scenarios were created for the project: one for the existing (authorized) navigation condition and one for the proposed conditions. The following information is required for the scenario setup:

a. The geometry of the navigation channels in the study area.

(1) The width.

(2) The depth.

(3) The side slopes.

(4) The overbank depths on each side of the channel.

b. The magnitudes and directions (azimuths) of the currents in the area.

c. The magnitude and direction (azimuth) of the wind in the area.

d. The wave height in the study area.

e. The visual scene and radar image.

5. To define the geometry of the navigation area, cross-section definitions were placed as shown in Figures 2 and 3 for the existing and proposed areas, respectively. The ship simulator model allows eight equally spaced points to be defined on each cross section. At each of these points a depth, current magnitude, and current direction are required. Also, for each cross section, a width, right and left side slopes, and overbank depth are required. Table 1 gives the values that were assigned for these parameters with the exception of the current magnitudes and directions which are discussed later in this part. Figure 4 shows a typical existing (as measured) cross section, the

Table 1

Cross-Section Parameters

Parameter	Authorized Channel	Proposed Channel
Width of Southampton Channel	600 ft	600 ft
Water depth (mllw)	35 ft	45 ft
Overbank depth (mllw)	28 ft	28 ft
Side slopes	1V on 2H	1V on 3H

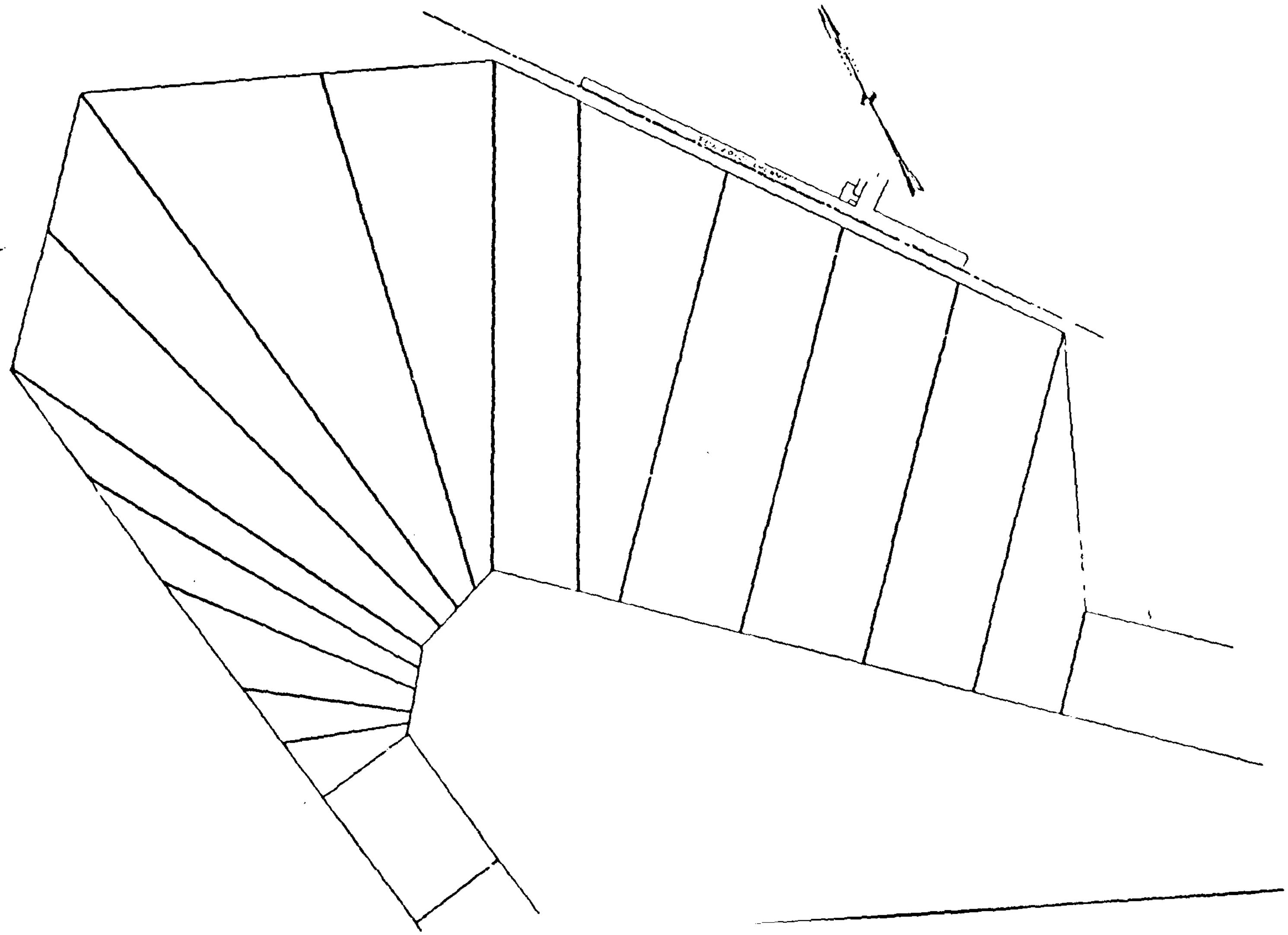

Figure 2. Cross-section layout, existing geometry

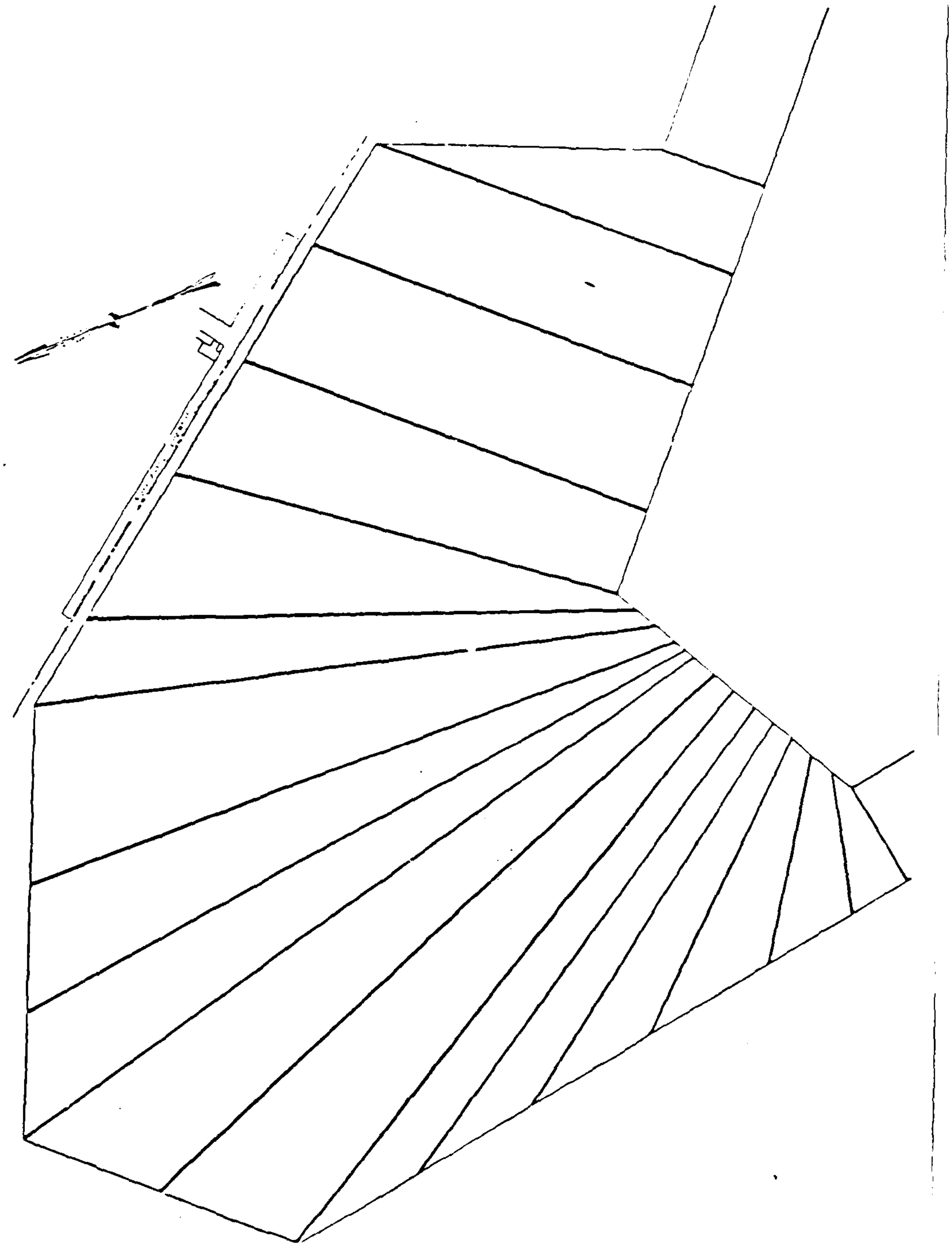

Figure 3. Cross-section layout, proposed geometry

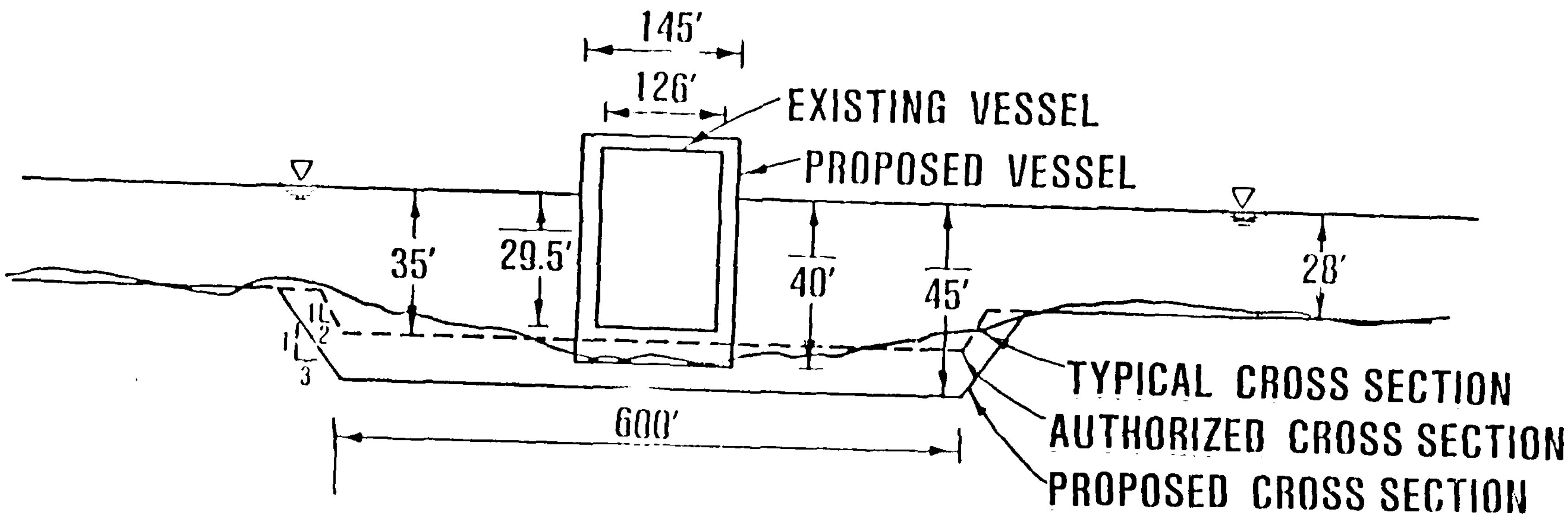

Figure 4. Typical cross sections, Southampton Channel

presently authorized cross section, and the proposed cross section. Note also the representation of the respective vessel sizes. It was determined that the draft-to-overbank depth was so small that there would be very small bank forces on the vessel; therefore a constant overbank depth of 28 ft was used.

6. Current data were obtained from the San Francisco Bay physical model. Nine miniature Price-type current meters were placed in the study area (Figure 5). Several tidal cycles (mean tide) were simulated and 40 current magnitudes and directions from each meter were recorded for each full tidal cycle. These data were recorded for each current meter on a current rose (Figure 6) as well as in tabular form. The maximum surface current magnitude (one each for flood and ebb tide) was chosen from each tide rose. Due to the fixed depth of the current meter and the variable water-surface elevations, it was felt that the measured surface currents would represent the average to maximum velocities acting on the vessel. This would result in a conservative design. For each meter location, this maximum current magnitude was found in the tabular data and the time period at which it occurred was recorded. The time periods were analyzed and the period that occurred the most often for each tidal condition (flood and ebb) was chosen to be the time at which the maximum currents occurred. The maximum currents are the most critical with respect to maintaining control of the vessel. These current magnitudes and their respective azimuths are shown in Figure 7.

7. A method of spatial averaging and smoothing of the current data was devised based on the Theissen Network used in hydrologic rainfall studies. The adjacent stations at which the current meters were positioned were connected by straight lines and a perpendicular bisector to each connecting line was erected. The polygons formed (Figure 7) by the perpendicular bisectors around each station enclose an area that is everywhere closer to that station than any other station. This area is best represented by the current magnitudes and directions at the enclosed station. A smoothing process was used in allocating the current magnitudes and directions to each of the eight points on each channel cross section (Figures 8 and 9). This was done to avoid abrupt changes in currents which would not be representative of real-world conditions. The smoothing method involved assigning to each point on each cross section the current magnitude and direction of the occupied area as well as a function for the magnitude and direction from each area adjacent

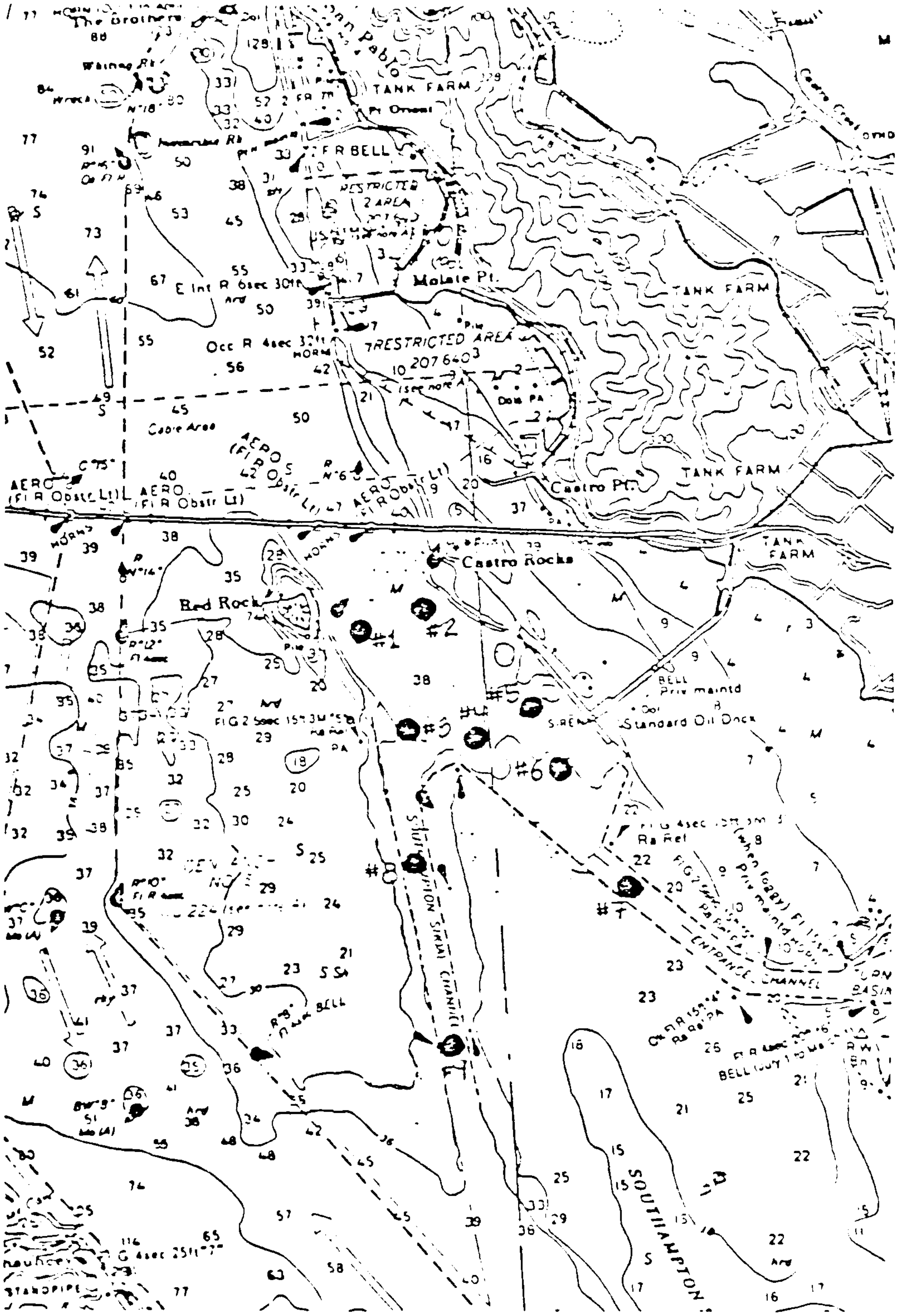

Figure 5. Current meter locations

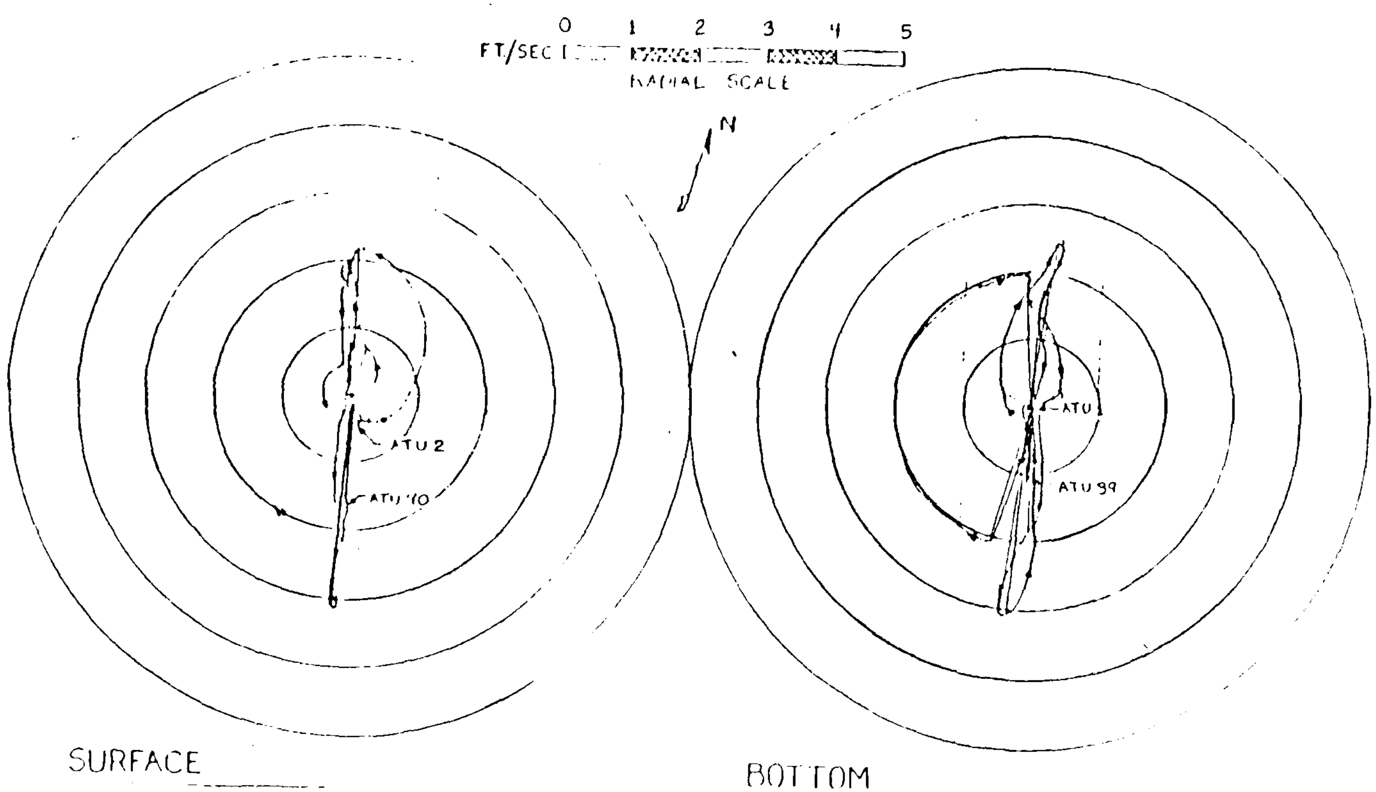

Figure 6. Current rose station #3

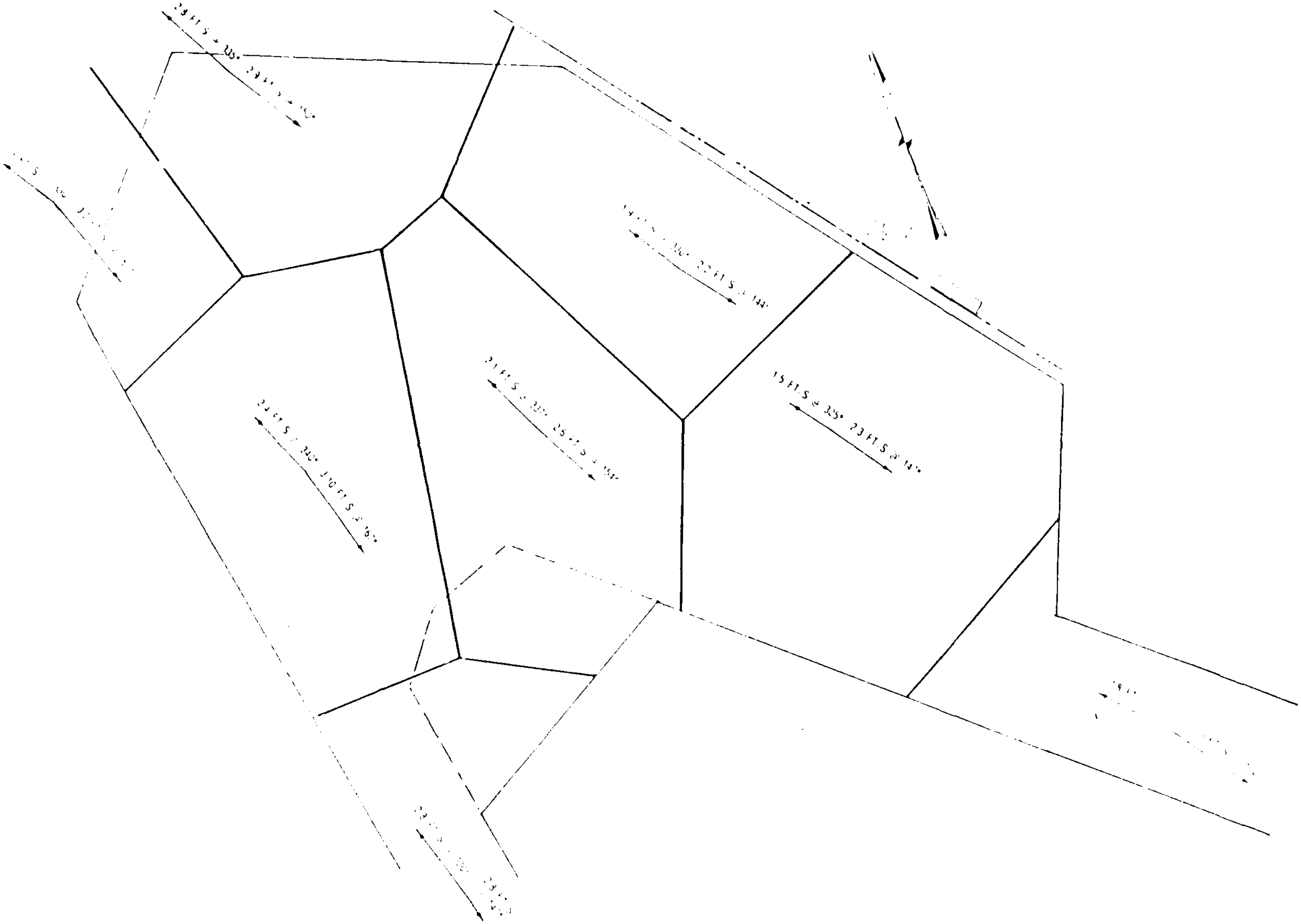

Figure 7. Average maximum currents (flood and ebb tide)

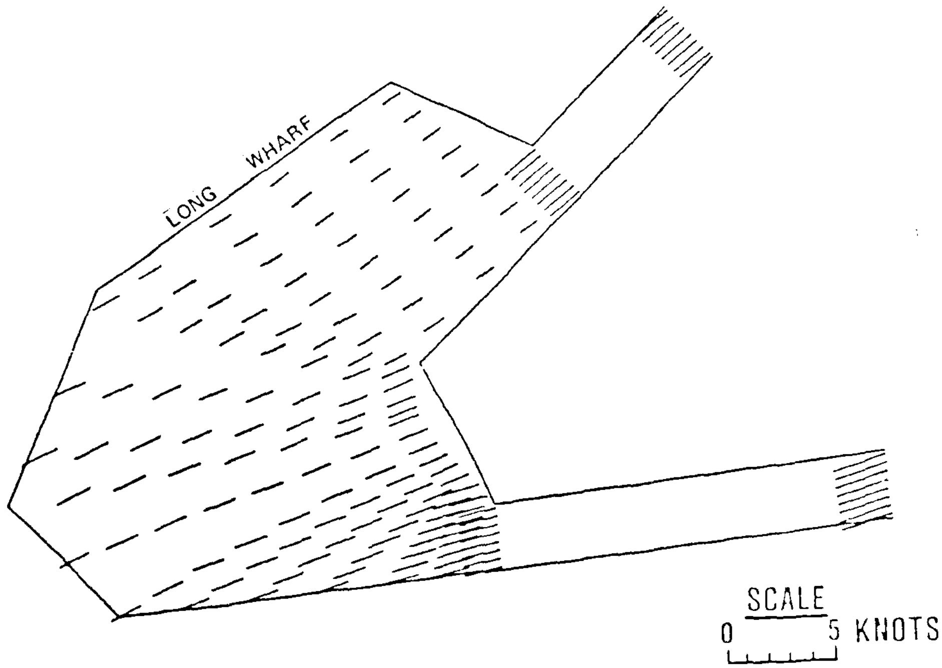

Figure 8. Current magnitudes and directions, flood tide

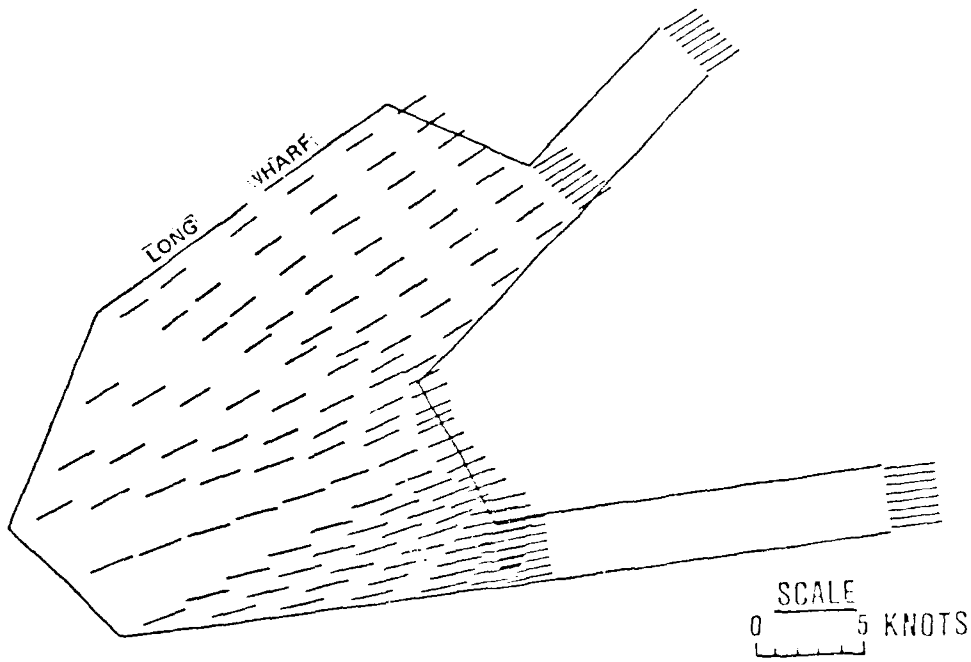

Figure 9. Current magnitudes and directions, ebb tide

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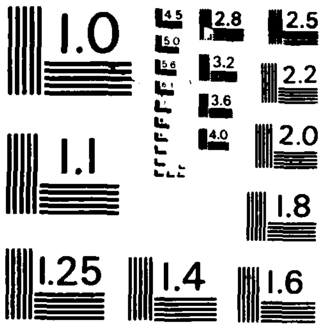


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

to the occupied area. These values were then weighted to the point in question by the use of Equation 1 where R is the distance from the point to the i^{th} current meter position, V is the current velocity, and A is the current azimuth.

$$\frac{\sum_{i=1}^{n} (V_i)\left(\frac{1}{R_i^2}\right)}{\sum_{i=1}^{n} \left(\frac{1}{R_i^2}\right)} \quad \text{and} \quad \frac{\sum_{i=1}^{n} (A_i)\left(\frac{1}{R_i^2}\right)}{\sum_{i=1}^{n} \left(\frac{1}{R_i^2}\right)} \tag{1}$$

8. The current data obtained from the San Francisco Bay model were checked using three other sources. A reasonably good correlation between the four was found. The other sources are listed below:

a. Tidal Current Charts for The San Francisco Bay; U. S. Department of Commerce, National Oceanic and Atmospheric Administration and The National Ocean Survey, July 1973.

b. 1983 Tide & Current Tables with Current Charts; Crowley Maritime Corporation, 1983.

c. Tides and Currents, San Francisco Bay; U. S. Coast and Geodetic Survey, 1873-1923.

9. The wind data used for the simulations were supplied by SPN. The predominant wind was determined to be from the southwest direction. For the flood tide maneuver, the wind would tend to drift the vessel to the north making the turn more difficult in very strong winds. A wind magnitude of 20 knots was used for all navigation tests which is typical of a summer afternoon bay wind. The wind was assumed to be at a constant magnitude and direction throughout the study area.

10. In the San Francisco Bay area, the wave heights and periods are very small; therefore wave forces on a large ship are negligible.

11. The visual scene is a color-filled perspective view of the navigation area that is computer-generated on a large (4 ft X 3 ft) rear projection television screen. It provides the pilot with the key visual navigation aids (buoys, channel markers, buildings, bridges, etc.) that are used in the real world situation. The information required to generate the visual scene must be encoded for the model in three dimensions: north-south, east-west, and vertical elevation. As the ship is moving, the three-dimensional picture is constantly being transformed into a two-dimensional perspective graphic image

representing the relative size of the objects in the scene as a function of the vessel's position.

12. Data sources used for the development of the visual scene are given below:

_a_. A video taping of a typical vessel transit.

_b_. Still photographic slides of the area taken from the land as well as from the vessel transit.

_c_. Topographic maps produced by the U. S. Geological Survey and published by the U. S. Department of the Interior.

_d_. Nautical charts produced by the National Ocean Survey, National Oceanic and Atmospheric Administration; chart No. 18649.

13. Items included in the visual scene consisted of buoys, channel markers, Chevron Long Wharf, some of the key buildings, the San Rafael-Richmond Bridge, the gas tank, oil pumpers, Red Rock Island, west land masses near San Quentin, east land masses extending from Pt. San Pablo south to Brooks Island, and all significant topography.

14. The radar image is a continuously updating plan view of the vessel's position relative to the surrounding area. The information supplied to the pilot by the radar consists of the radius of the image being generated, a visual location of the vessel, and all of the objects that are coded into the visual scene. The information required to generate the radar image is common to the information required to generate the visual scene.

PART III: TEST PROCEDURES

15. The study consisted of two test cases. The first case was the base condition and tested the ability of 87-kdwt tankers to maneuver in the presently authorized 35-ft-deep Southampton Shoal Channel, the Long Wharf maneuvering area, and to approach the Long Wharf in a correct docking posture without tugboat assistance. The second case was the proposed or deep channel, and tested the ability of 150-kdwt tankers to maneuver from the Southampton Shoal Channel, through the Long Wharf maneuvering area, and into a correct docking posture at the Long Wharf (also without tugboat assistance). The impact of channel deepening on Richmond Harbor navigation was also investigated by testing the ability of two different containerships to maneuver from the Southampton Channel, through the Long Wharf maneuvering area, and into the Richmond Harbor entrance channel.

16. Three pilots were used in the testing program; their respective backgrounds are given below.

- a. Pilot A is an experienced WES engineer familiar with the hydrodynamics of ship behavior on the simulator but is naive from a ship piloting standpoint.
- b. Pilot B is a new WES engineer who has some familiarity with the hydrodynamics of the simulator but has no ship piloting experience.
- c. Pilot C is an experienced Chevron tanker master and an active pilot familiar with tanker response and piloting into the Long Wharf.

17. The investigations consisted of testing the following channel-tanker-tide conditions:

- a. The authorized 35-ft-deep channel with an 87-kdwt partially loaded tanker to nearly 30-ft draft (see Table 2 for ship particulars).
- b. The proposed 45-ft-deep channel with a 150-kdwt partially loaded tanker to 40-ft draft (see Table 2 for ship particulars).
- c. Conditions (a) and (b) were tested with both flood and ebb tide currents as shown in Figures 8 and 9.
- d. All tests were for inbound transits and for ships loaded to the maximum draft that the channel design would allow.

18. The base tests were conducted in such a manner as to reproduce existing conditions (with the exception of tugboat assistance) to verify the scenario setup as well as the ship simulator model response. Once existing

Table 2

Ship Particulars, Typical Tankers

Ship	Load Condition	Capacity kdwt	Length ft	Beam ft	Draft, ft Partial Load	Full Load
Chevron California	Partial	70	801	105	28.5	42.8
Simulated base ship	Partial	87	763	125	29.5	40.0
Chevron H. J. Haynes	Partial	150	899	160	40.0	52.8
Simulated design ship	Partial	150	915	145	40.0	52.0

conditions were verified, the proposed channel and tanker test configurations were run. Table 5 (page 23) gives a complete outline of tanker tests completed.

19. Prior to collecting the data from the trials listed in Table 5, approximately six familiarization trials were required for Pilots A and B and two for Pilot C.

20. In addition to the tanker runs, tests were conducted with the proposed 45-ft-deep channel with a 638-ft and an 810-ft containership (Table 3 for ship particulars). The tide conditions (Figures 8 and 9) were the same as

Table 3

Ship Particulars, Typical Containerships

Ship	Capacity kdwt	Capacity TEU*	Length ft	Beam ft	Draft ft
Sea Land SL-7	20-35	1220-1230	725-944	95-105	33-38
APL President Lincoln	30	1750	821	106	29.6
Marad design	40	2500	810	106	29.6
Simulated design ship	44	2600	810	106	32.0
Simulated design ship	15	882	638	100	32.3

* Total equivalent units.

those tested with the tankers. Only Pilots A and B performed testing of the containerships and only inbound transits were tested. Table 5 includes tests completed with the containerships.

21. All tests began with the vessel located at the center of Southampton Channel near channel markers 3M"1" and 3M"2" (the south end of Southampton Channel) with the heading being the same as the channel itself (353 deg). The initial speed of the 87-kdwt and 150-kdwt tankers was 5 and 2 knots, respectively; the initial speed of the containerships was 5 knots. All speeds listed are with respect to the bottom of the channel.

PART IV: TEST RESULTS

22. When analyzing the test results presented here and in Appendix A, it should be kept in mind that all of the vessel transits were completed without the assistance of tugboats. With the assistance of tugboat simulation it would have been possible to totally simulate the procedures used in the real world; however, it is felt that if the vessels can perform the required maneuvers without the assistance of tugboats, then having the assistance provides an optional safety factor. The rationale of the study is that by comparing the behavior of the existing vessel in the present channel with the proposed vessel in the proposed channel, it is possible to answer the questions being posed by this project.

23. The navigation maneuvers required to dock the tankers at the Chevron Long Wharf or to turn the containerships into the Richmond Harbor entrance channel allow many variations in pilot strategies. While the strategies may vary, different maneuvering commands can still result in a safe and successful transit of the ship.

24. Before presenting the analysis of the test results, it is necessary to explain the nomenclature used in presenting the results. The following abbreviations are used in this chapter as well as in Appendix A.

- a. Existing conditions - base test - BT
- b. Proposed conditions - deep test - DT
- c. Flood tide - FT
- d. Ebb tide - ET
- e. 87-kdwt tanker, partial ballast - 87PB
- f. 150-kdwt tanker, partial ballast - 150K
- g. Pilot X, repetition N - XN

25. Results with respect to the tankers were analyzed by comparing the base tests and the deep tests for any one pilot. Although an analysis between pilots is possible, it is felt that a comparison (BT to DT) of each pilot's strategies was a better comparison of the test results and defines the relative impact of the proposed channel.

26. Test results of the containership tests were analyzed as one group of tests. This procedure was used instead of the "within pilot" comparisons for the following reasons:

a. No base test trials were simulated.

b. Only two pilots were used in the testing.

c. Not more than three repetitions were made for each test condition.

27. Table 4 gives the inbound navigation requirements for a successful ship transit; i.e. ship course, crosscurrent set, and required change of course. This information is presented so the reader can refer to the various values of these parameters when analyzing the data presented later in the report. It should be pointed out that the combination of current sets of 40 deg, required turns of 150 deg, and right then left turns in an area as limited as the Long Wharf maneuvering area requires special consideration when piloting these large vessels.

Table 4

Inbound Navigation Requirements

	Flood Tide, 320 deg AZ			Ebb Tide, 175 deg AZ		
Navigation Area	Ship Course deg	Current Set deg	Change of Course	Ship Course deg	Current Set deg	Change of Course
Southampton Shoal Channel	352	32-L	--	352	3-L	--
Long Wharf Dock	144	4-R	152-R	324	31-L	62-R 90-L
Richmond Harbor entrance channel	132	8-L	140-R	132	43-R	140-R

28. Selected test results are presented and discussed to illustrate the type of information generated and the methodology used in analyzing the data. The discussions presented consist of comparisons of the 87-kdwt tanker tests with the 150-kdwt tanker tests as well as three sets of results from the containership tests. The configurations of these tests were:

a. Tankers - flood tide - Pilot A

b. Tankers - ebb tide - Pilot B

c. Tankers - flood tide - Pilot C

d. Tankers - ebb tide - Pilot C

e. 638-ft containership - ebb tide - Pilot B

f. 810-ft containership - flood tide - Pilot B

g. 810-ft containership - ebb tide - Pilot B

Table 5 provides a complete list of all tests run during the study. Full data sets for each of these tests are presented in Appendix A in the same order as the tests are listed in Table 5. The study conclusions (based on a detailed analysis of all of the tests) are presented in PART V.

Table 5

Successful Trials Used for Analysis

Pilot	Ship	Base Test	Deep Test	Flood Tide	Ebb Tide	No. of Trials
A	87PB	X		X		4
A	150 KDWT		X	X		4
B	87PB	X		X		4
B	150 KDWT		X	X		4
C	87PB	X		X		2
C	150 KDWT		X	X		2
B	87PB	X			X	4
B	150 KDWT		X		X	4
C	87PB	X			X	1
C	150 KDWT		X		X	1
A	810-ft containership		X	X		2
B	810-ft containership		X	X		2
A	810-ft containership		X		X	3
B	810-ft containership		X		X	3
B	638-ft containership		X		X	1

Figure 10 shows the general paths the pilots follow in order to dock the tankers at the Chevron Long Wharf. It is emphasized that these are only typical paths and deviations may be readily accepted if the ships remain in

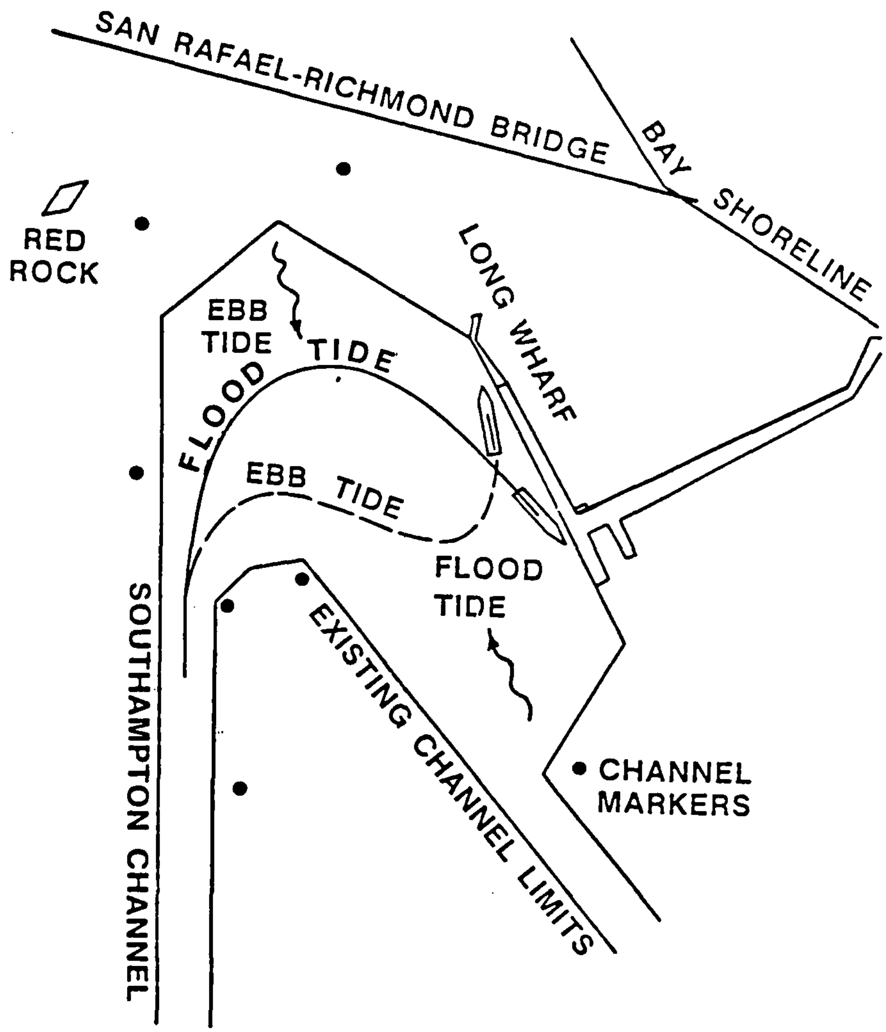


Figure 10. Pilot inbound, maneuvering strategy

the maneuvering area. The paths will vary as a function of the ship size; the test runs showed that the bow of the 150-kdwt tanker in the ebb tide situation could not be pointed as far south as the bow of the 87-kdwt tanker and still reach an acceptable docking posture.

30. Figures 11-14 are a complete set of ship data comparisons for a tanker base test and deep test with flood tide conditions and Pilot A in control. Figure 11 is a plan view of the tankers swept path with respect to time: the greater the distance between the vessel outlines, the faster the vessel is traveling. A comparison of the two diagrams shows the 87-kdwt vessel traveling very high (i.e. farther north) in the maneuvering area, making the turn quite rapidly, and approaching the Long Wharf with very little lateral motion. Conversely, results from the 150-kdwt tanker simulation show that the turn is initiated much sooner and that the larger tanker is unable to make as sharp a turn. As a result, the larger tanker approaches the Long Wharf at a larger angle so that the tanker is "crabbing" or having a large "drift angle" attitude (very little forward motion with a large amount of lateral motion). This maneuver is quite safe and is considered to be an acceptable procedure.

31. Figure 11 also shows both vessels crabbing to the right in the Southampton Channel. This crabbing compensates for the flood tide current angle to the channel. The crabbing angle experienced in this reach of the channel (15 deg with the 87-kdwt tanker) resulted in a maximum swept path of approximately 320 ft. This result will have an impact on the width of the Southampton Channel required for safe tanker navigation.

32. Figure 12 (for the same test) presents plots of distance along ship track plotted against rudder setting, engine rpm, distance off track, and ship speed for the two different vessels. The distance along track and distance off track represent values relative to the average track lines shown in Figure 15. The path which each individual pilot will desire to make may deviate from these average paths; therefore the plotted distance off-track values should only be used as a relative locater from the average track lines.

33. Each plot has a line representing zero on the y-axis. This line has a small circle on it representing the position at which the vessel would reach the end of Southampton Channel and begin entering the Long Wharf maneuvering area. The circle for the deep tests is located about 1,000 ft prior to that of the base tests due to the proposed change in the geometry (plan

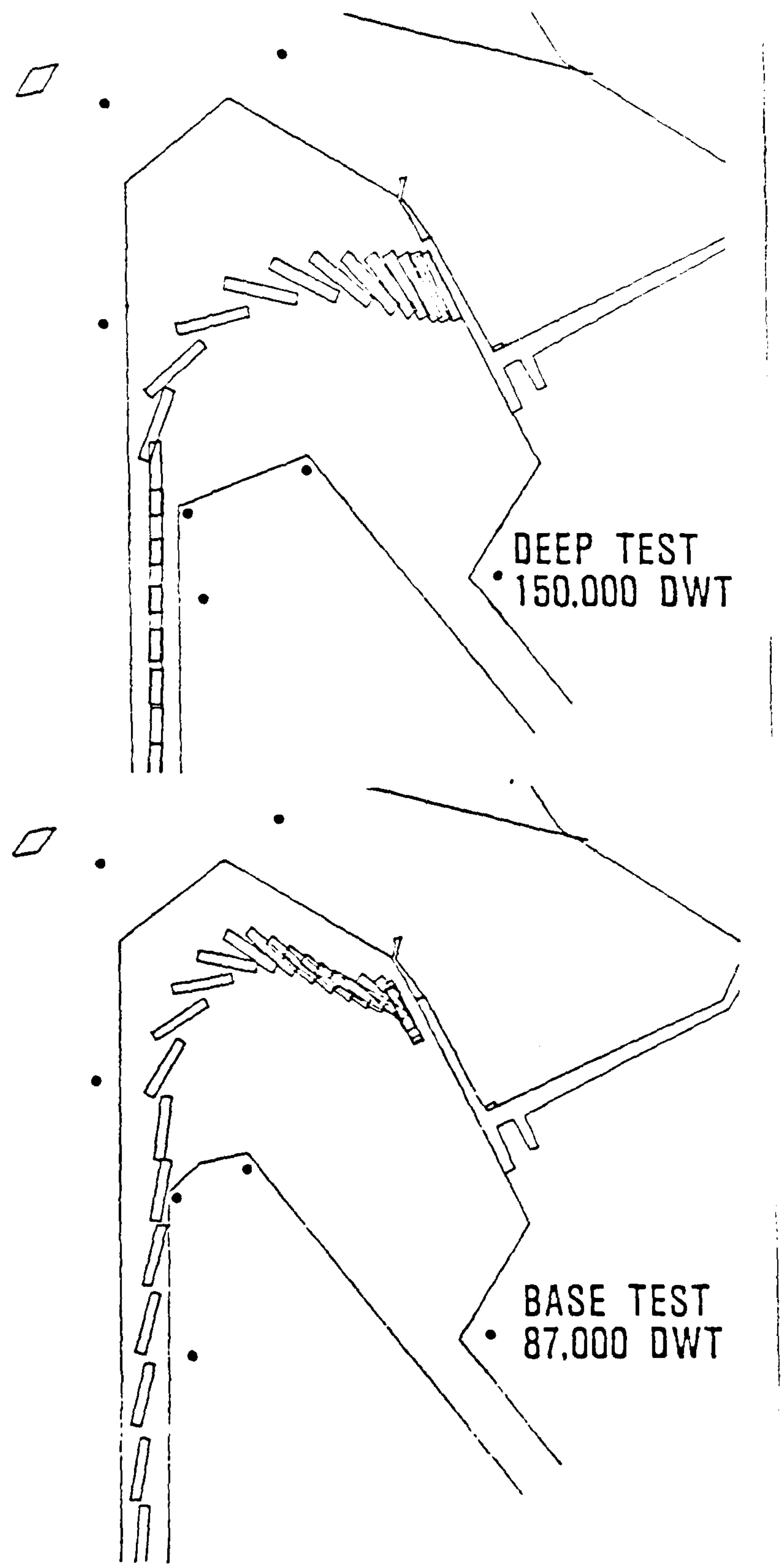
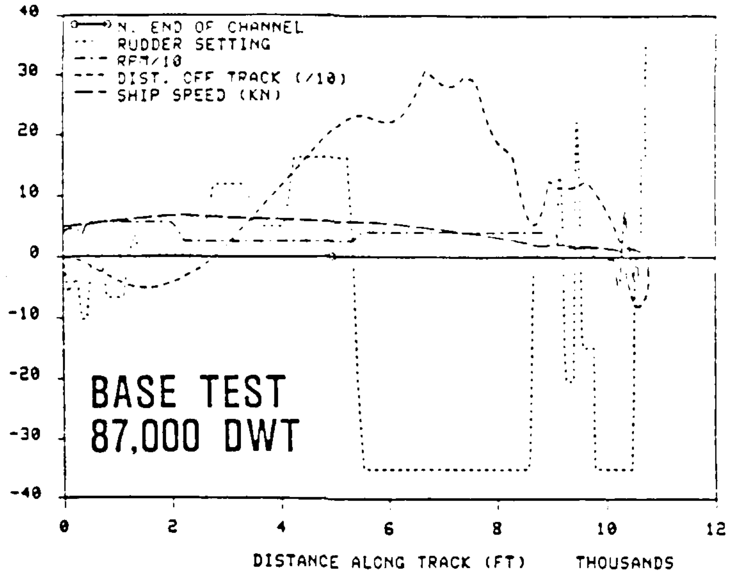


Figure 11. Ship tracks, flood tide, Pilot A



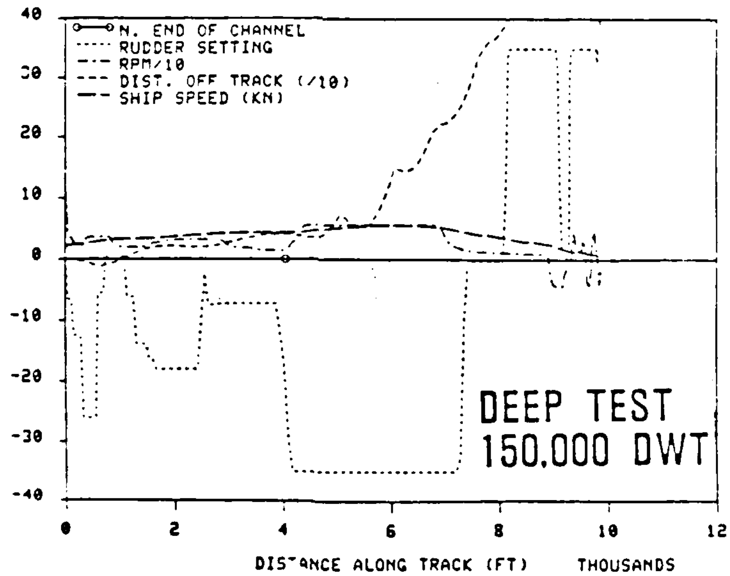


Figure 12. Maneuvering data, flood tide, Pilot A

view) of the channel/turning basin. Notice the change in the "nose" of the turning area in Figure 15.

34. Referring to Figure 12, both tests have large rudder settings for the first 1,000 ft of the transit in the Southampton Channel. This is due to the fact that the vessel was initially positioned parallel to the heading of the channel and an initial adjustment of the heading was required to compensate for the crosscurrents. The 150-kdwt tanker required larger rudder settings to achieve the compensation because of its larger mass, lower rpm setting, and its larger projected area available to the currents. Near the entrance to the turning area (small circle on the graph), notice the combination of the increase in rpm with the full right rudder. It is useful to analyze the rudder settings in combination with the rpm settings because the effectiveness of the rudder is a strong function of how much water the propeller is pushing (or pulling) past it. This type of maneuver is referred to as a "kick-turn" by pilots. Its purpose is to achieve a quick increase in the rate of rotation of the vessel without a great deal of increase in speed. The larger rudder angle provides the turning action as well as acting as a significant drag force. This type of maneuver is repeated near the track distance of about 9,000 ft; however, the concept is the reverse. A full left rudder in combination with a reverse propeller will also result in an increase in the rate of rotation to the right. One advantage of this method is that the reverse propeller helps in lowering the vessel speed; however, it should be pointed out that this type of maneuver (reverse kick-turn) is not as effective as an ahead kick-turn in rotating the ship. Lastly in Figure 12, the ship speeds can be evaluated. The smaller vessel had a larger ship speed until a track distance of about 9,000 ft where it slowed down to about 2 knots and then 1 knot. The larger vessel maintained a lower speed throughout the entire test and was much less responsive (with respect to speed) to the kick-turn. The reason for this behavior is that the vessel is much more difficult to accelerate and decelerate due to its larger mass.

35. The plots on the last 2,000 ft of Figure 12 were invariably very difficult to interpret. Because this was an important area to analyze the behavior of the vessel, the "docking posture" of the vessels was analyzed in more detail. Figure 16 is a definition sketch of the docking parameters which were felt to be of significant importance. Criteria with respect to the proper docking posture were developed to be used as a guide and are listed below:

a. The distance from the vessel to the wharf should not be less than one length of the ship. At this point, the vessel is no longer under its own power and the tugboats could perform the remainder of the docking procedures.

b. The angle between the wharf and the vessel should be no greater than about 15 deg.

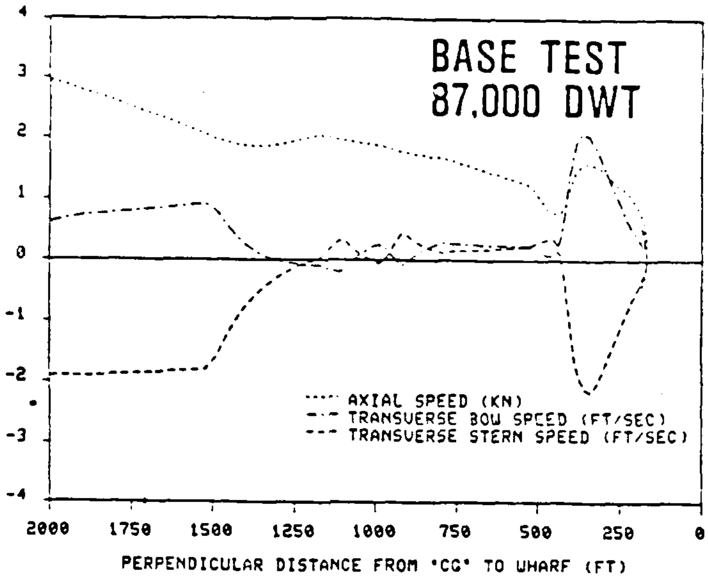
c. The axial speed of the vessel should be less than 1 knot.

d. The transverse speed of the vessel should be less than 1 fps.

36. Figure 13 represents the docking speeds (for the same test as analyzed above) of the two ships as they approached the Long Wharf. Due to the large drift angles experienced with the 150-kdwt tanker, the speeds were broken down into three components; i.e. axial speed, transverse bow speed, and transverse stern speed. Negative transverse speeds represent movement of that portion of the vessel to the left (with respect to the vessel) and positive to the right. Negative axial speeds represent the movement of the vessel backward and positive speeds represent forward motion. When analyzing the transverse speeds, the rate of rotation of the vessel is represented by one transverse speed being greater than the other. A change in the direction of the rate of rotation occurs where the two lines intersect. If both transverse speeds (bow and stern) have the same algebraic sign, then both ends of the vessel are approaching or leaving the wharf regardless of the difference between the two speeds.

37. Referring to Figure 13, the pilot of the 87-kdwt tanker did a fine job of approaching the wharf with the tanker located about 400 ft away from the wharf when he began a turn. In a prototype situation, the tugs would have taken over here regardless of the distance away from the wharf. In this case, the test results show that the pilot commanded a quick kick-turn and moved the vessel closer to the dock under its own power. In comparison, the 150-kdwt vessel's axial speed was quite high (2.3 knots) approximately 750 ft away from the wharf. This is where the pilot applied the reverse kick-turn and one can see the decrease in axial speed along with some increase in rotation. This was followed by an overcompensation which reversed the rotation; however, the speeds are sufficiently low and the docking posture is considered to be adequate.

38. Figure 14 is used to analyze the physical posture of the vessel as it approaches the wharf. For these plots, the position and orientation of the vessel (relative to the wharf) are presented. These graphs are to the same



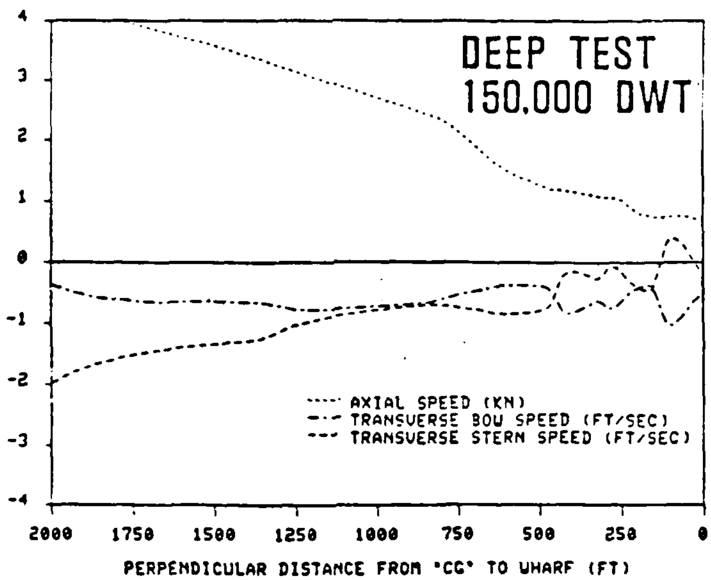
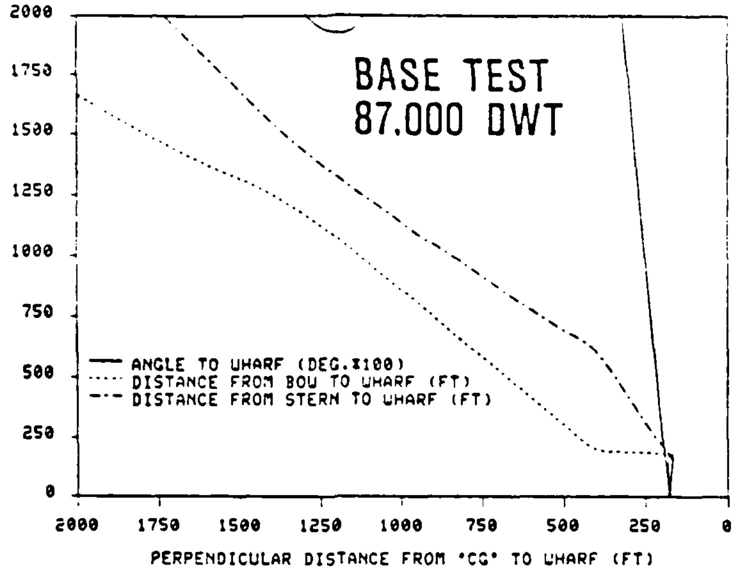


Figure 13. Docking speed, flood tide, Pilot A



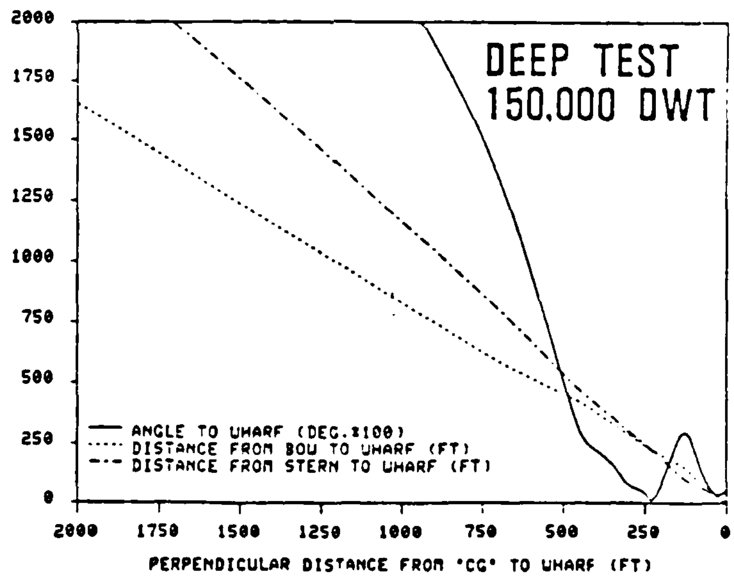
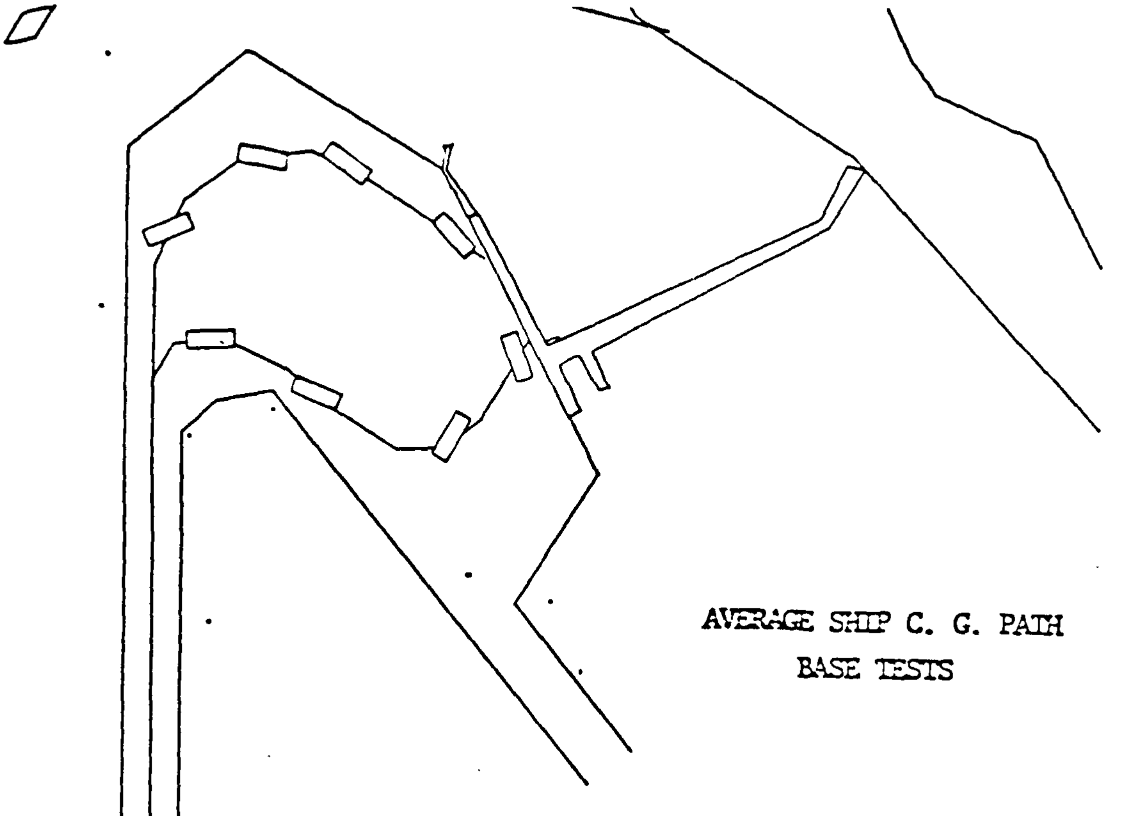


Figure 14. Docking posture, flood tide, Pilot A



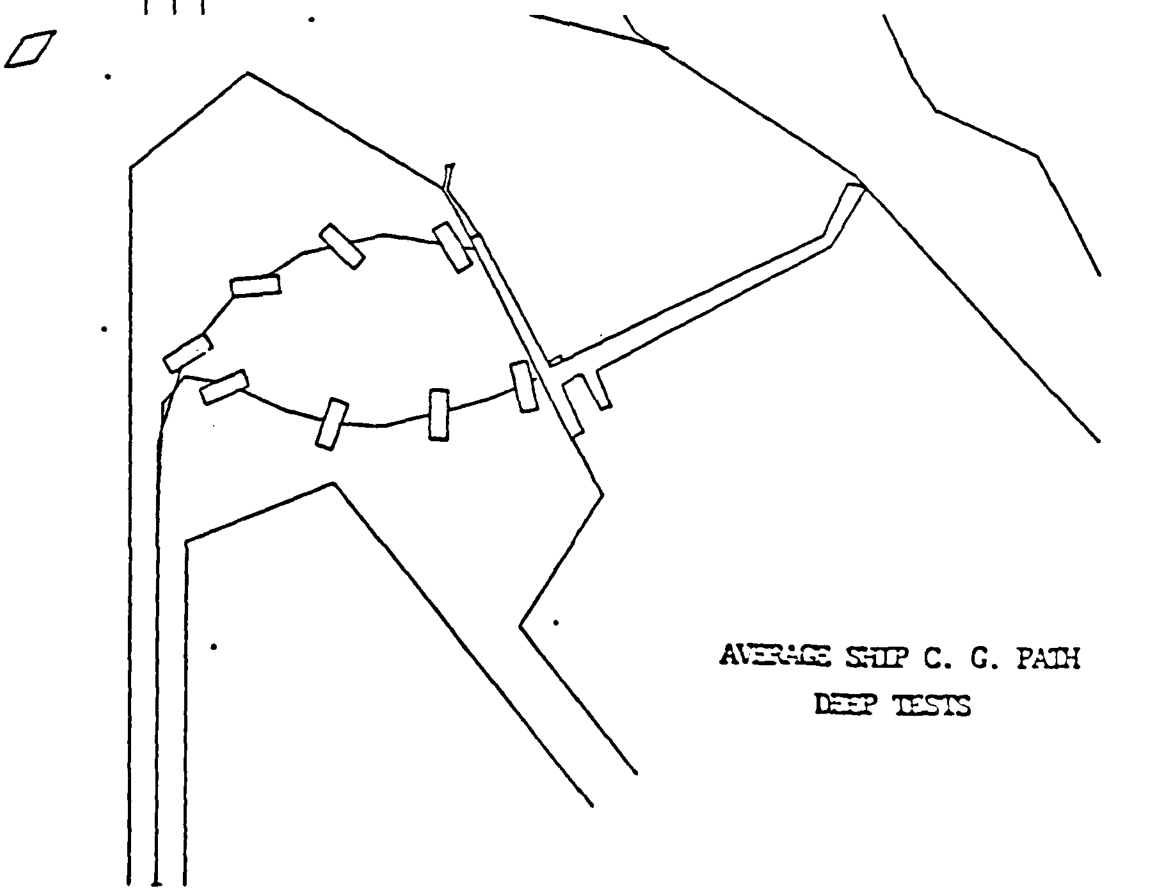


Figure 15. Average tanker paths

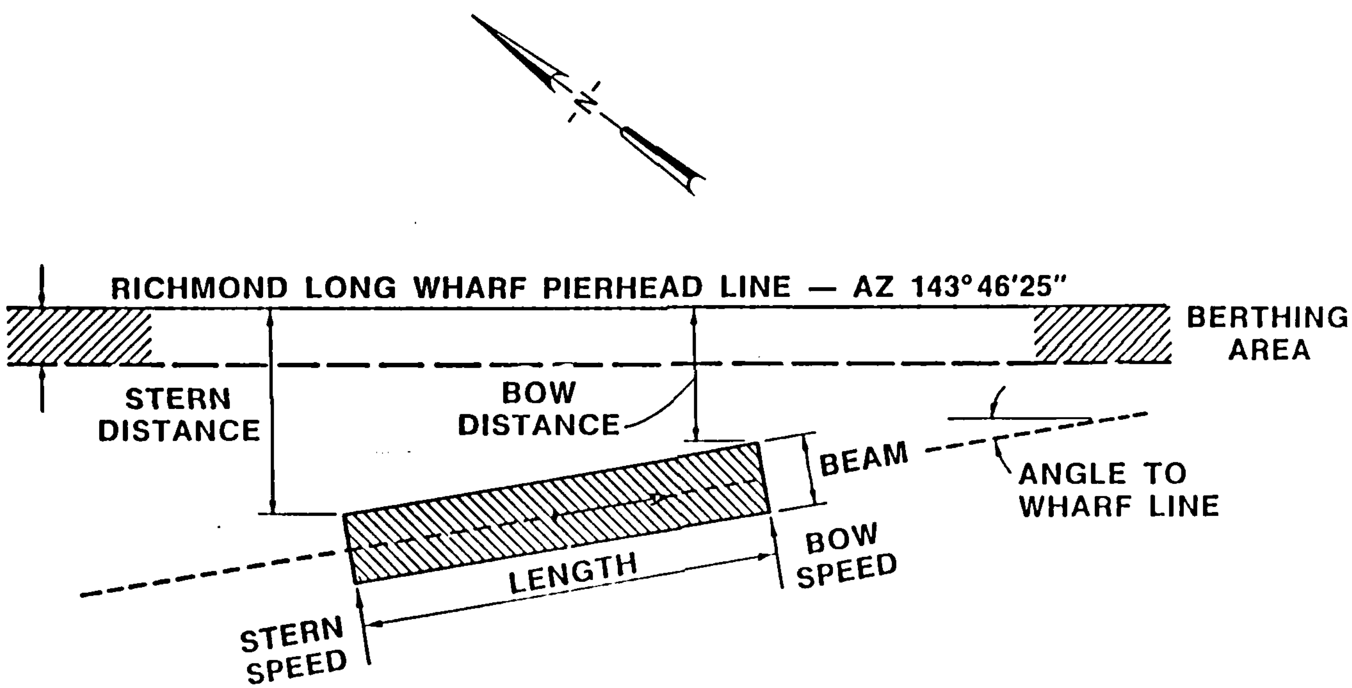


Figure 16. Ship docking posture, definition sketch

scale as the graphs in Figure 13 so the overall speed/position at any point approaching the wharf can be analyzed. The more parallel the bow and stern distance lines remain, the more uniform the vessel is in approaching the wharf. The closer the two lines are together, the more parallel the vessel is to the wharf. The angle between the vessel and the wharf will never be less than zero for when this occurs, the angle is measured from the back side of the wharf. Referring to Figure 14, both vessel pilots have done an excellent job of achieving a proper docking posture. The 87-kdwt vessel managed to keep the approach angle more uniform than the 150-kdwt vessel. This can be attributed to the axial approach instead of the crabbed approach used by the 150-kdwt vessel.

39. Graphs of the types used in the previous four comparisons are available in Appendix A for every test listed in Table 5. This explanation for all four sets was used to show the results from one comparison of base and deep tests (flood tide), as well as to provide the reader a methodology for interpreting the other sets of graphs presented in Appendix A. The discussion of other tanker tests does not include a full set of comparisons for each test. Instead, selected plots are presented to illustrate how strategies differed with pilots or test conditions.

40. Figures 17 and 18 are graphs comparing a set of tests for the two tankers under ebb tide conditions with Pilot B in control. Figure 17 shows both tankers beginning the right turn at approximately the same position in the maneuvering area. It can be seen that the larger tanker does less turning, resulting in the bow of the vessel remaining pointed more toward the wharf. If the bow of the 150-kdwt tanker were to move down farther than a position which was perpendicular to the wharf, it was found that it was impossible to bring it back up to a proper docking posture. This is due to the ebb tide currents acting on the left side of the vessel. It is obvious that the 87-kdwt tanker had no problem making the left turn into the currents and obtaining a proper docking posture. Figure 17 shows that both vessels' sterns came close to the bank near the nose of the maneuvering area. It was not necessary for the smaller vessel to hug the bank in this area shown by the extra maneuvering room that was available at the end of the test; however, the larger vessel needed all of the space that was available.

41. Figure 18 is a comparison of the maneuvering data for the same test as above. The 150-kdwt tanker has more and larger rudder activity in the

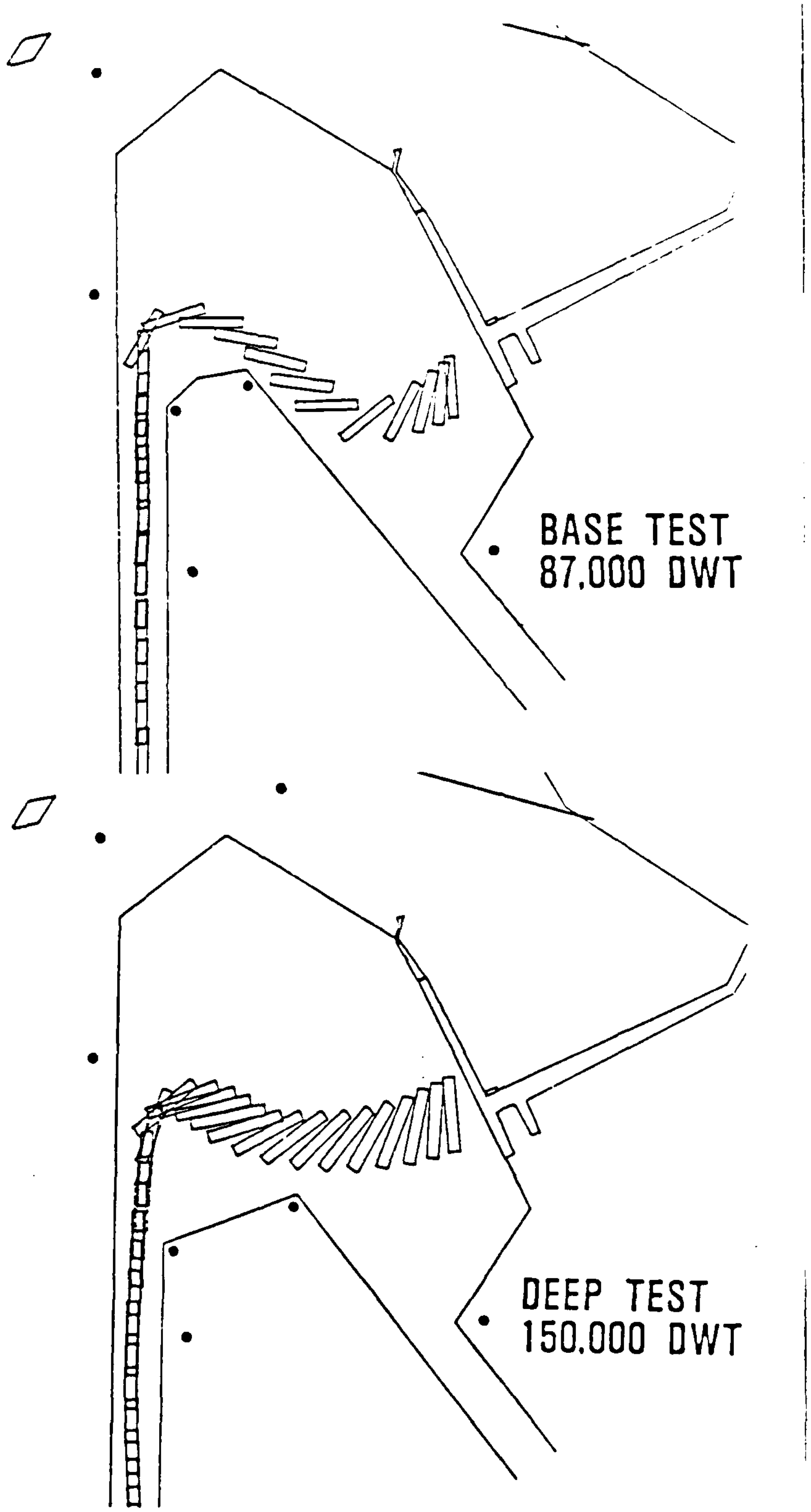
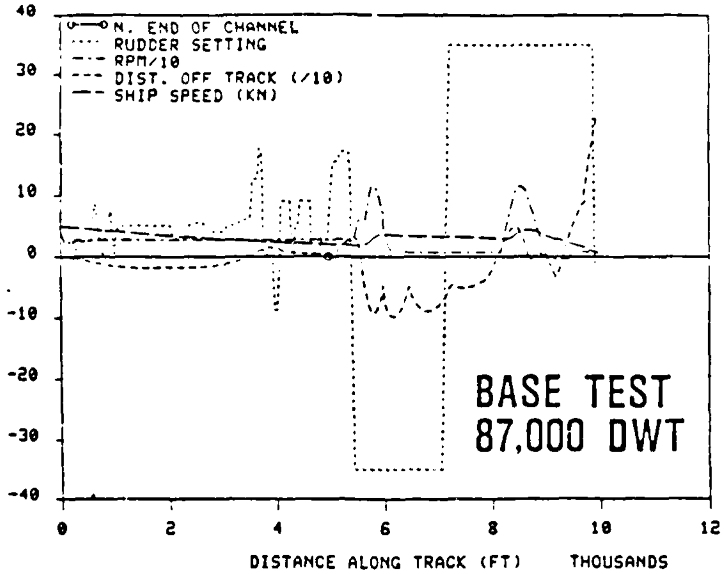


Figure 17. Ship tracks, ebb tide, Pilot B



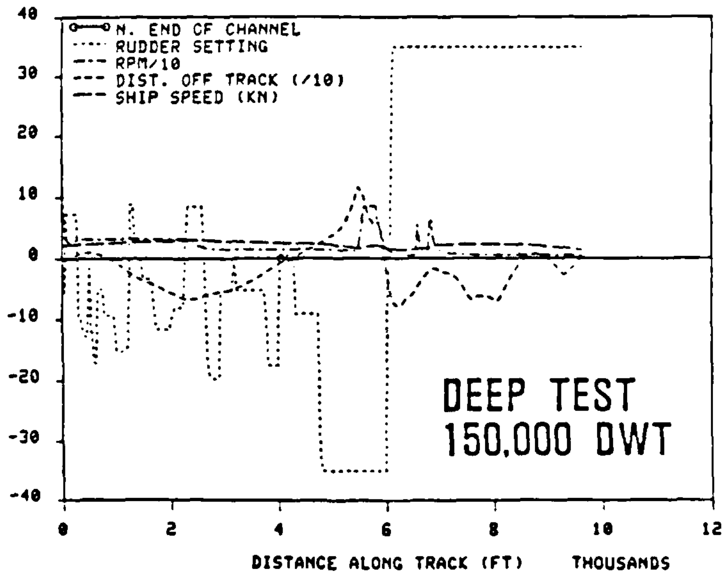


Figure 18. Maneuvering data, ebb tide, Pilot B

reach of the channel prior to the turn; however, the 20-deg values are still acceptable. Both vessels perform a very pronounced kick-turn to initiate rotation to the right just after the opening from Southampton Channel into the Long Wharf maneuvering area. Following this, the 150-kdwt tanker has two very short bursts of propeller in combination with a left rudder to keep the bow of the vessel in an "up" position. Later in the sequence, the 87-kdwt tanker performs a stronger left kick-turn to rotate the bow of the vessel into a proper docking posture. The speed of the 87-kdwt tanker is about 4 or 5 knots while the 150-kdwt tanker makes the transit at a much slower and constant speed of about 2 knots.

42. The remaining tanker tests presented here were completed by a Chevron pilot. Pilot C tended to position the vessel a greater distance from the Long Wharf at the docking posture. His comment at that time was, "With the ship in this position, you can do anything you want with her." This represents one of the cases where different pilots have different strategies.

43. Figure 19 is a comparison of the two tanker transits with flood tide. It appears that Pilot C makes the same general maneuvers as Pilots A and B with the 87-kdwt tanker; however, the maneuver with the 150-kdwt tanker shows no crabbing over to the wharf as Pilot A does in Figure 11. Pilot C chose to use a reverse kick-turn near the entrance to the maneuvering area to reduce the speed of the vessel while increasing the rate of rotation to the right. The simulation test results show that this procedure proved to work very well.

44. Figure 20 is a comparison of the two tanker transits with ebb tide. Both transits were performed with the same general strategy in mind as that used by Pilot B; however, Pilot C tends to keep both vessels located higher (farther north) in the turning basin. This is acceptable unless it is desired to dock the vessel at the lower end of the wharf. Pilot B's strategy (Figure 17) would be considered to be the maneuvering limit to Pilot C's strategy. Pilot C's strategy (with both vessels) is to keep the bow of the vessel pointed upward and let the ebb tide push the vessel over toward the wharf. In time, the 87-kdwt tanker would have drifted closer to the wharf due to the ebb tide. Both tests shown in Figure 20 would be considered successful transits.

45. The following discussion illustrates the type of analysis used for the containership tests. All three tests presented here were conducted by

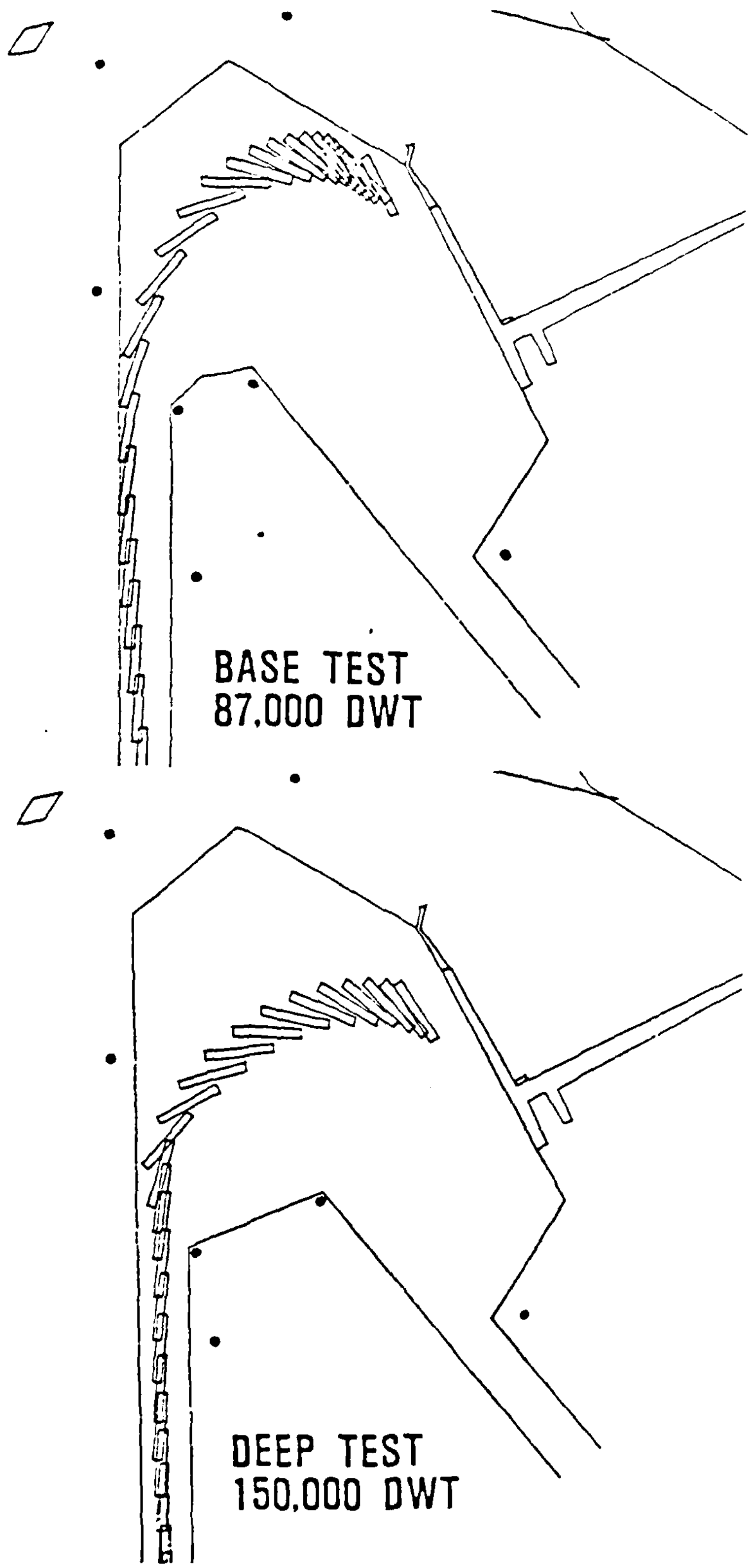


Figure 19. Ship tracks, flood tide, Pilot C

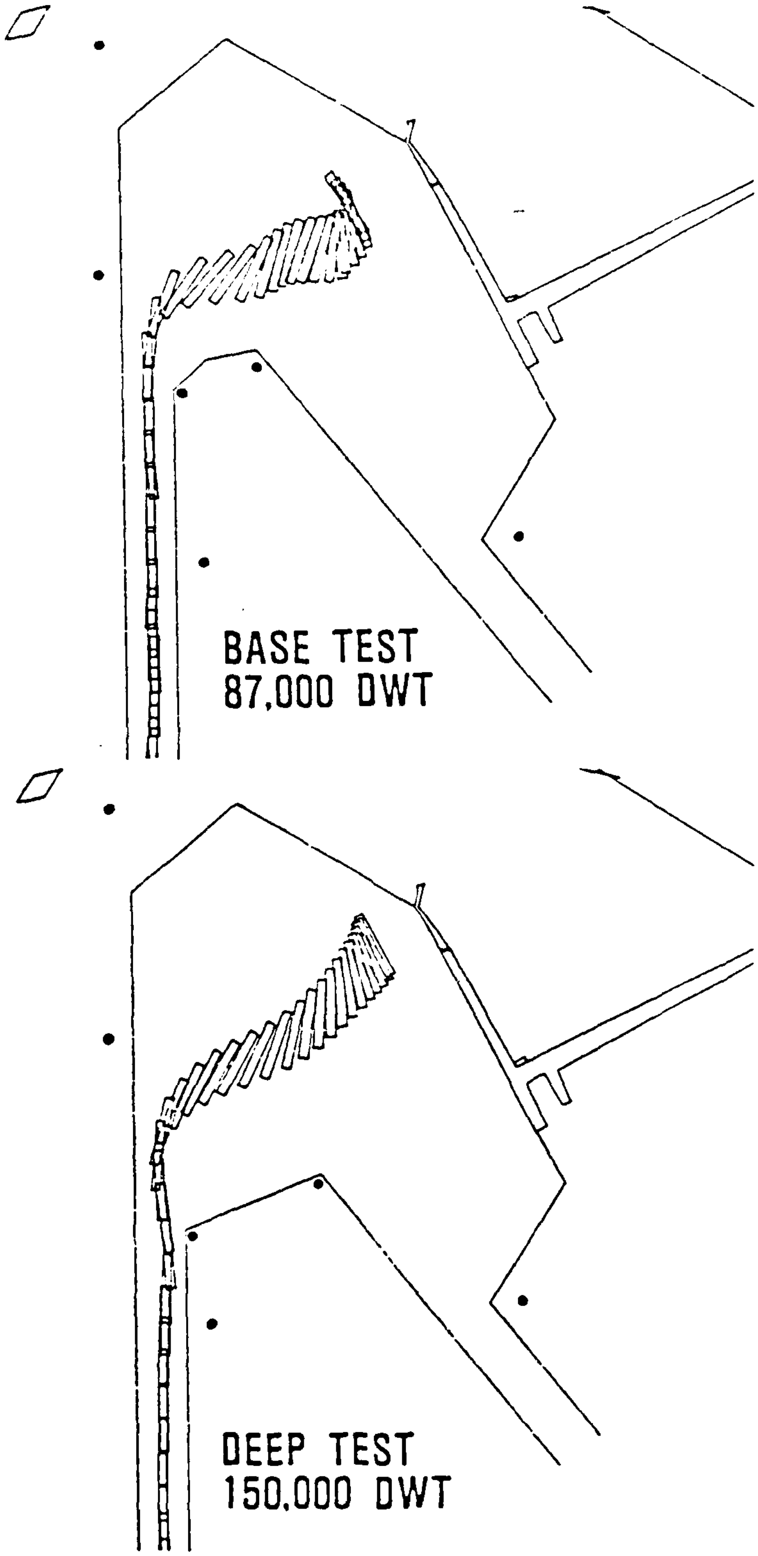


Figure 20. Ship tracks, ebb tide, Pilot C

Pilot B. It was initially decided to test the maneuverability of an 810-ft containership under the proposed project conditions. This containership is not presently being used in this area; however, with the proposed Richmond Harbor deepening project, it would be feasible to begin using such a vessel. The larger 810-ft containership under the ebb tide conditions proved to be very difficult to control. A 638-ft containership presently being used in the area was also tested to evaluate the impact of the John F. Baldwin project on present-day containership traffic into Richmond Harbor.

46. After completing several containership tests, it was found that the cutoff nose of the turning basin was of no benefit to the containerships. As a result of this, containership tests were run for the deep test depths (45 ft) but without the 1,000-ft nose cutoff. Therefore both the BT and DT nomenclatures represent 45-ft depths.

47. Figure 21 shows the average containership paths that were used to plot the values of distance along track and distance off track. The paths should only be used as a relative locater for the vessel. In Figure 22, three small circles are plotted on the line representing zero on the y-axis. The first represents the point at which Southampton Channel meets the Long Wharf turning basin, the second represents the point at which the vessel would be located perpendicular to the north end of the Long Wharf, and the last represents the entrance to the Richmond Harbor entrance channel.

48. Figure 22 is a plan view of the 810-ft containership's transit with the maneuvering data for the flood tide conditions. Once again a large crabbing angle is necessary in the Southampton Channel to compensate for the crosscurrents experienced for this tide condition. The transit required a right kick-turn around the nose of the turning basin followed by a smaller left kick-turn to line up and enter the Richmond Harbor channel. The clearance between the left side of the vessel and the left bank was plotted in the maneuvering data (port clearance) to analyze how close the vessel came to the Long Wharf. In this case, the vessel was always greater than 1,000 ft away from the wharf. The speed of the vessel was very much influenced by the kick-turns (reaching a maximum of 8 knots); however, the speed did decrease and stabilize following the kick-turns as the vessel headed into the currents. This would be considered to be a safe maneuver.

49. Figure 23 is the only test with the 810-ft containership with ebb tide that could be considered to be a marginally safe maneuver. The response

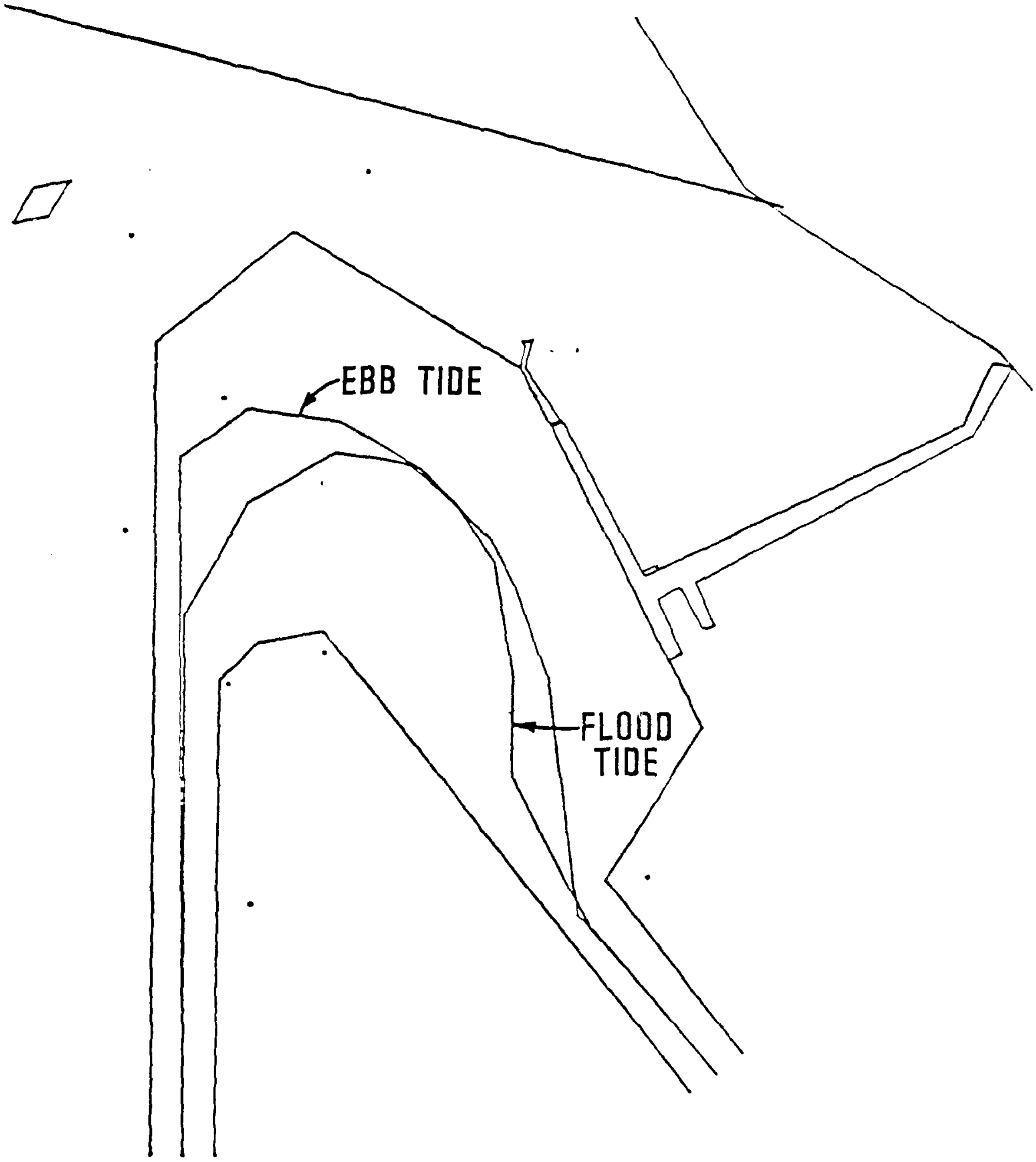


Figure 21. Average containership paths

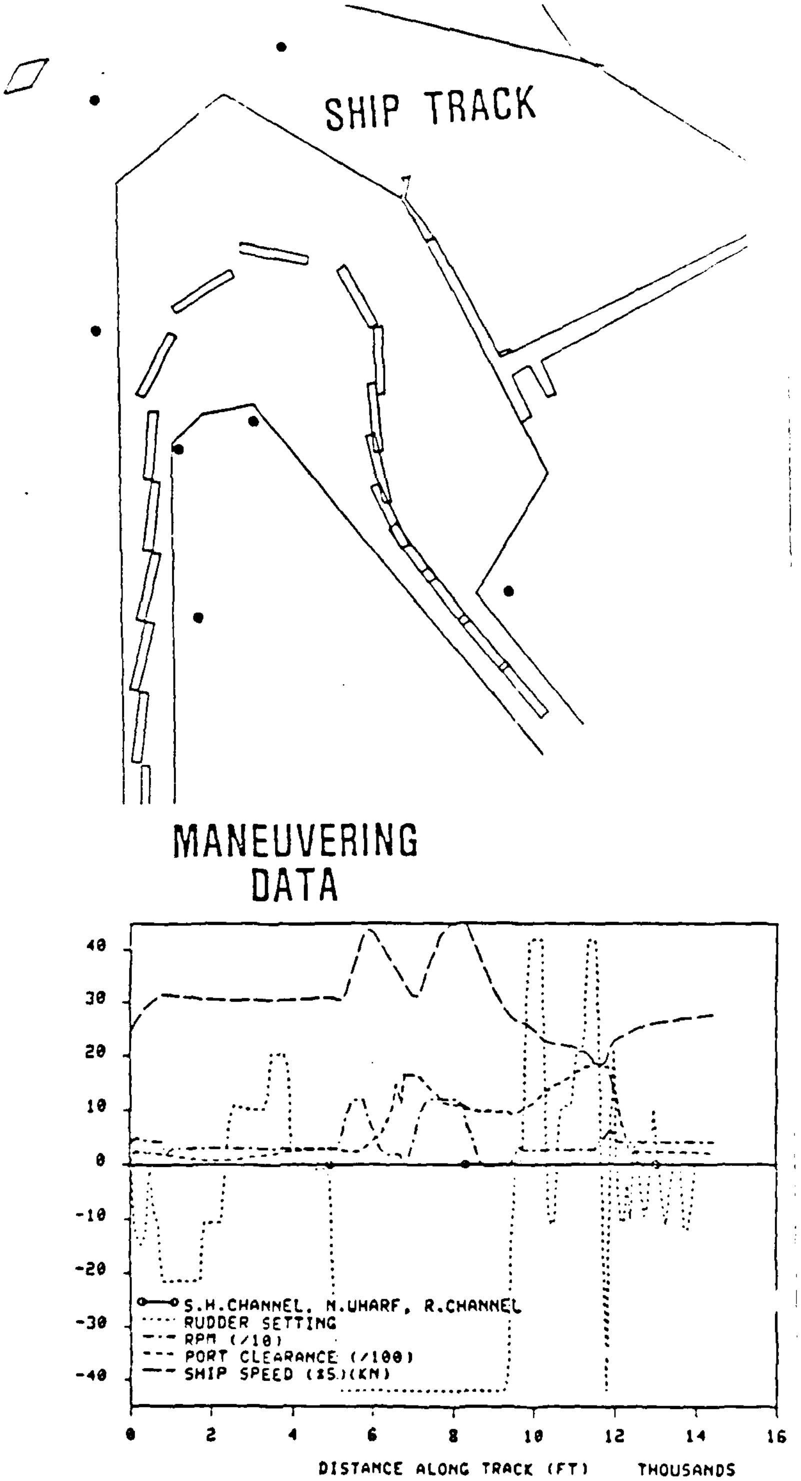


Figure 22. 810-ft containership test, flood tide, Pilot B

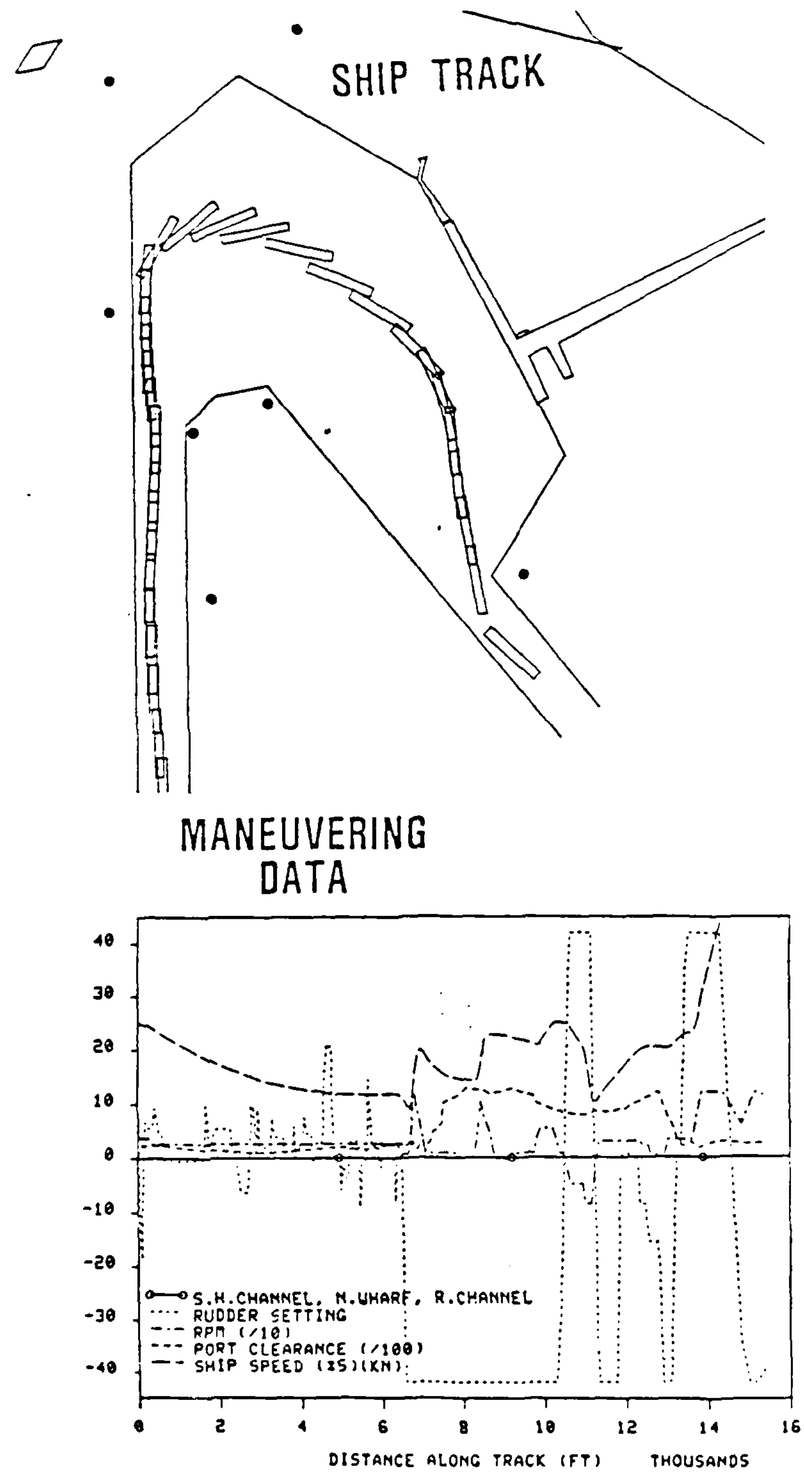


Figure 23. 810-ft containership test, ebb tide, Pilot B

from the right kick-turn caused an increase in speed that was very difficult to reduce due to the tide pushing the vessel in the direction of travel. A reverse right kick-turn reduced the vessel speed to a point where a left kick-turn could be completed to line the vessel into the Richmond Harbor channel. It should be pointed out that the left kick-turn did cause another increase in speed that may have caused further maneuvering problems outside of the study area. This maneuver did result in a safe minimum port clearance of 1,000 ft; however, the controllability of the vessel is in question at several points in the transit. Further investigation into bringing the 810-ft containership into Richmond Harbor (especially with the ebb tide) should be considered before the deepening of Richmond Harbor is authorized. One other possibility would be to require tugboat assistance for this maneuver.

50. Due to the difficulty of containership control during ebb tide inbound transits with the larger 810-ft containership, it was decided to study the proposed Baldwin project (essentially a deeper channel and maneuvering area) using a smaller, more typical containership which is presently calling at the Richmond Harbor. Results from a transit with a 638-ft containership (ebb tide) presently being used in the area are plotted in Figure 24. The difference in maneuverability between the larger and this smaller vessel is dramatic. The implementation of a simple right kick-turn resulted in turning the vessel into a position in which it was perfectly lined up to enter the Richmond Harbor channel with an excess of time and distance to slow the vessel to a safe entrance speed. At the same time, the minimum port clearance was approximately 2,000 ft.

51. The following comments are an overview of all the tests with saved data on the computer discs and as presented in Appendix A. The order in which the tests are given in Appendix A is the order in which they are listed in Table 5.

52. The larger 150-kdwt tanker always required more crabbing than did the smaller 87-kdwt tanker which tended to approach the wharf from the north in a direction along the wharf (Figures A1-A40). Pilot A docked the larger tanker very high (farther north) on the first two tests (Figures A9 and A11) but was able to make a tighter turn in the next two tests (Figures A13 and A15). This is also true of Pilot A's base tests. Pilot B's second base test (Figure A19) was the best base test due to the uniformity throughout the turn as well as obtaining the desired final docking posture. The other three

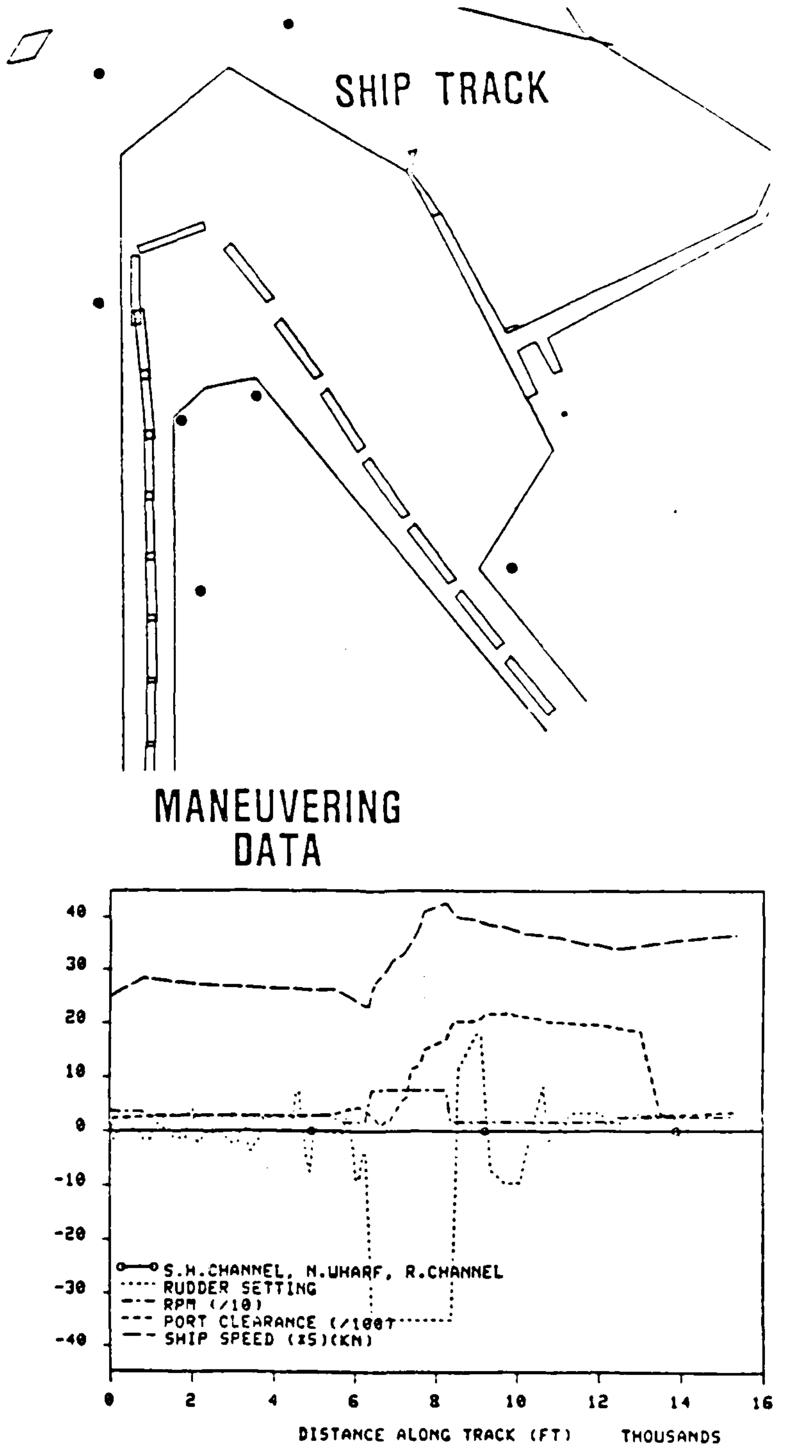


Figure 24. 638-ft containership test, ebb tide, Pilot B

base tests show only small variations on both sides of this test which indicates a high degree of consistency with succeeding tests. In the deep tests, Pilot B was fairly consistent with the exception of DTFT B4 (Figure A31) where he docked the tanker farther north than in the previous three tests. This happened when the pilot was distracted while performing this particular maneuver. Pilot C's first base test (Figure A33) shows the tanker approaching the wharf in a uniform pattern, while his second test (Figure A35) shows the implementation of a second very long kick-turn that resulted in the docking posture being achieved quite a distance from the wharf. From this position, the vessel could be docked at any of the four berthing areas. The next two deep tests (Figures A37 and A39) show Pilot C crabbing across the maneuvering area and positioning the vessel closer to the wharf but still leaving space enough to dock at any of the berthing areas.

53. The strategies for the transits under ebb tide conditions vary significantly between the two tankers as well as between pilots. Pilot B's transits with the smaller tanker (Figures A41-A48) involve a right-then-left kick-turn, positioning the tanker near the south end of the wharf so the pilot could maneuver the vessel into the currents while approaching the desired berthing area. Pilot C positioned the vessel farther north, letting the current drift the vessel down into the desired berthing area (Figure A57). The later strategy is used by both Pilots B and C when maneuvering the larger tanker under ebb tide (Figure A49-A56 and Figures A59-A60).

54. The 810-ft containership tests under flood tide are presented in Figures A61-A64. All four of these tests were very successful transits. The only inconsistency is Pilot B's first transit (Figure A63). The vessel was set into the required right turn before leaving the Southampton Channel resulting in a tighter turn around the nose of the turning basin. The 810-ft containership tests under the ebb tide (Figures A65-A67) were all unsuccessful transits. The controllability of the vessel decreases when it is traveling in the direction of the current due to a decrease in relative speed of the rudder with respect to the water. Also the use of a kick-turn in this situation causes an unacceptable increase in speed.

55. The 638-ft containership transit (Figure A68) under the ebb tide conditions was discussed earlier and it was pointed out that it was a very easy maneuver to complete with success.

PART V: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

56. Results of the simulations show that a 150,000-dwt tanker loaded to 10-ft draft, greater than is now possible, can be maneuvered with acceptable margins of safety in the proposed channel; experienced pilots familiar with the project should provide additional safety factors.

57. Acceptable tanker docking postures can be achieved on flood tide for the existing and dredged channels using the 87-kdwt and the 150-kdwt tankers, respectively. The larger tanker tended to drift farther north in the maneuvering area.

58. Maneuvering inbound with ebb tide is somewhat easier than with flood tide. The larger tanker, however, requires special care to keep the ship bow well into the ebbing current. Successful docking postures can also be obtained for ebb tide.

59. All tests indicate that it is critically important to reduce forward speed in Southamption Channel to 5 knots or less before starting the large right kick-turn into the maneuvering area.

60. The 810-ft containership tests on flood tide indicate that maneuvering around the point and lining up with the Richmond Harbor entrance channel can be done but require considerable rudder activity.

61. Ebb tide conditions require very careful control of the 810-ft containership speed to no more than 4 knots before starting the right kick-turn. The simulation results indicate that the containership must be well into the maneuvering area before the start of the turn in order to have enough space for lining up with the entrance channel.

62. Cutting off the nose at the turning point as proposed by the San Francisco District does not seem to be beneficial except to the large tankers during ebb tide conditions.

63. The combination of crosscurrents and wind and the necessity of reducing ship speed in Southampton Channel result in a crab angle that increases ship maneuvering lane width above the normal design allowance.

64. A training period of about six simulations was required in order to produce consistently successful inbound docking posture maneuvers with the

loaded tankers. A similar training period was required for the containership runs.

65. A comparison of simulation results indicates that the proposed dredging project will not degrade the safety margin of tanker navigation into Long Wharf, especially if the present practice of using two 2,000-hp tugs and dropping anchor is continued.

66. The 638-ft containership tests indicate that the dredging project will not have a significant detrimental impact on the safety of present-day containerships maneuvering around the point.

Recommendations

67. A smaller cut of the turning point nose is recommended as being adequate, based on the simulation results. Two small dredging cuts at the north and south ends of the maneuvering area are recommended to improve the safety margin (Figure 25).

68. Some channel marker relocations are recommended as a result of the simulation tests. The recommended relocations are shown in Figure 25.

69. A reduction in width of the Southampton Channel from the present 600 ft is not recommended.

70. It is recommended that additional containership simulations of the large right turn and maneuvering into the Richmond Harbor entrance channel be conducted before Richmond Harbor is authorized for deepening to allow the newer, larger containerships access.

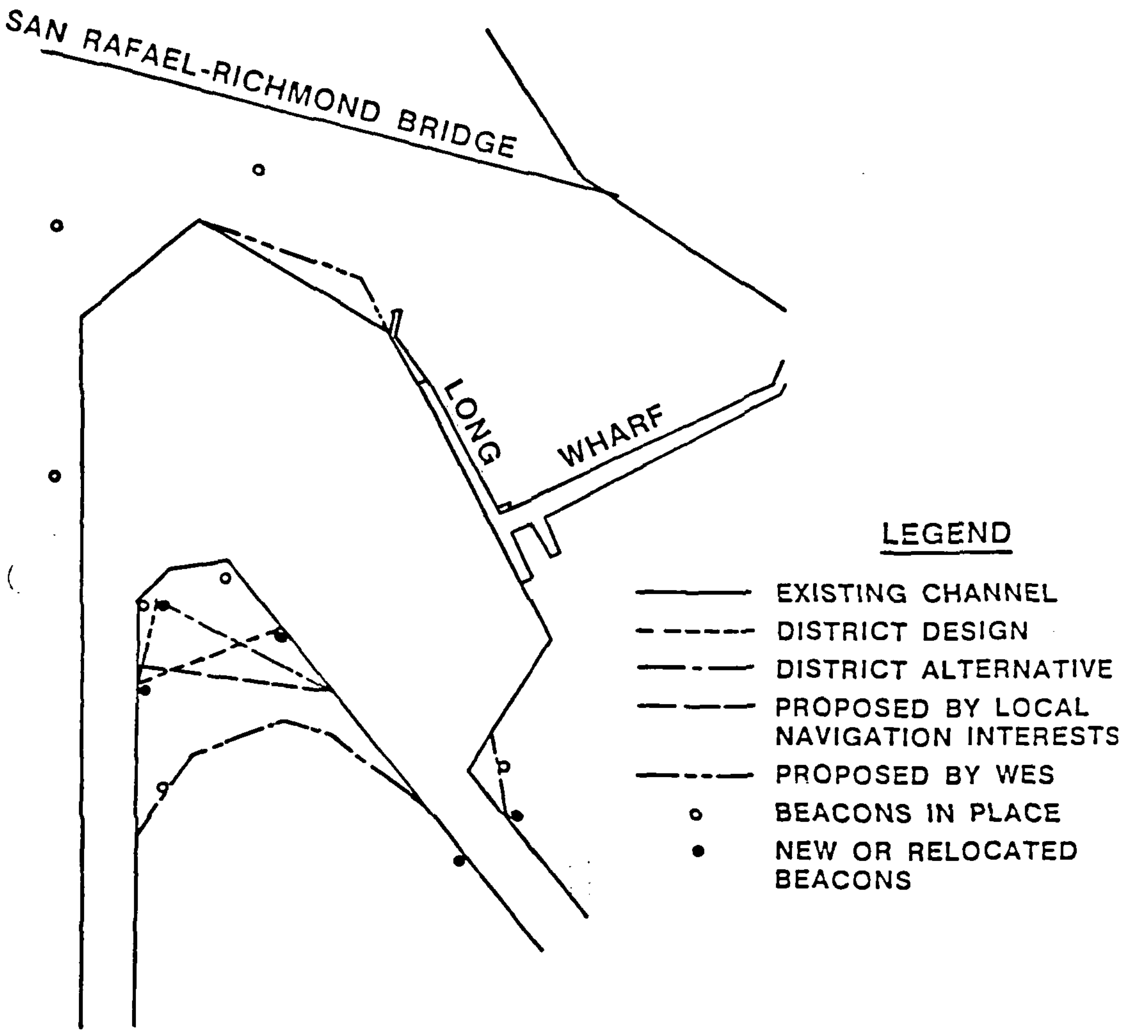


Figure 25. Alternative designs, maneuvering area

APPENDIX G
PUBLIC INVOLVEMENT

PUBLIC MEETING

JOHN F. BALDWIN SHIP CHANNEL, PHASE II

- - -

Thursday, February 16, 1984

United States Army Corps of Engineers

San Francisco District

The meeting was held at 7:30 p.m. in the Conference Room of the Bay Model, 2100 Bridgeway Road, Sausalito, California; COLONEL LEE, Chairman, presiding.

PRESENT: <u>Army Corps of Engineers Staff, SF District:</u>

Mr. Chisholm
Mr. Lew
Mr. Kuhn
Mr. Soper
Mr. Eft

<u>Army Corps of Engineers, South Pacific Division:</u>

Mr. Merino
Mr. Klug
Ms. Getzon

I N D E X

P R O C E E D I N G S

7:40 p.m.

COLONEL LEE: Good evening, ladies and gentlemen.

I would like to welcome you all here to the public meeting on the John F. Baldwin Ship Channel, Phase II. Our purpose here tonight is to answer questions concerning the project and the Draft Report on the project which the Corps has issued.

And I would like first to welcome and make known to you a few of the folks who are here. First of all, the sponsor of the local county, Contra Costa, Mr. Tom Powers, who is a Supervisor. He'll be saying something in just a moment.

Representing our higher headquarters, the South Pacific Division of the Corps of Engineers, we have Mr. Jaime Merino, Mr. Bill Klug and Mrs. Beverly Getzon.

We also have a number of members from our staff in the San Francisco District of the Corps. And rather than introduce them now I think I'll introduce them as they speak. Virtually all of them here are going to be making presentations to you of a few minutes in various aspects of the project, one exception being my Deputy, Major Melvin Watanabe, who is in mufti back there also in attendance.

Our purpose aside from informing you is to gain public input as we move into the next and final phase of

preparing the Design Memorandum and the Environmental Impact Statement. The way we're going to run it this evening is, first of all, we're going to have a little statement of support by the sponsor, following which we are going to have a review of the report in briefing format by members of our staff. And at the conclusion of that I would like to call on any members of the public or agencies, state or federal, who would like to make a statement. And I would like to urge you to hand in a card, if you haven't already done so, if you would like to make a statement.

At the conclusion of those briefings by our staff and statements by public and private parties we'll take a short break, during which time you will have an opportunity to write down any questions you may have on the sheets that were provided outside and will be passed out if you missed them during the course of the briefings or right afterward.

We will collect the questions, distribute them to the appropriate presenter, and then have the presenters in turn answer those questions. We hope that by following that routine it will add a measure of order and completeness to the proceedings.

I would ask that if you do speak please do so from the front of the room, and prior to speaking would you please state your name and the entity that you represent? And I would ask you to keep your statements, if you would,

to five minutes.

For those who would like to have a verbatim record of the proceedings tonight they will be available. Everything is being recorded and will be turned into a written record by Mr. Mike Connolly, our Reporter. And you can either see him after the public meeting, or should you leave early or miss him you can call him at 566-7004. And he can give you information on how to get a verbatim record of the proceedings.

With that I would like to ask Mr. Tom Powers, Supervisor of Contra Costa County, if he would please open it up for the sponsoring agency.

MR. POWERS: Thank you, Colonel Lee.

I am Tom Powers, Supervisor of Contra Costa County, and I represent the First District, which includes much of the western end of Contra Costa and the waterfront areas of Richmond and El Cerrito.

The John F. Baldwin and Stockton Ship Channel and this Phase II project is located within my supervisorial district. I appear before you tonight to reaffirm the support of Contra Costa for the John F. Baldwin and Stockton Ship Channel projects.

My county has supported this project since its inception many years ago and has been designated as the local sponsor since it was first approved by the Corps of

Engineers and the Congress. I wish to thank the Corps of Engineers for its fine work and support on this project, and personally to thank you, Colonel Lee, for your hospitality this evening.

The county has always taken a leading role in the development of this project and I personally have been involved in the studies, hearings and meetings since I first joined the Board of Supervisors. In early 1980 I appeared before the United States Senate and Congressional Committees to submit testimony in support of the channel work, not only of the Baldwin portion but also the Stockton portion of the channel.

At those hearings I testified that we supported the early construction of the phase that is now before you and urged that studies be made into and completed to determine if the balance of the channel can be completed without adverse environmental impacts to the bay and delta waters. This project is important to national and local interests, not only as it serves the immediate waterfront activities of Chevron and the Port of Richmond, but as it affects the upstream channel activities involved with much of the petroleum industry and other waterfront industries along the San Pablo Bay, Carquinez Straits and Suisun Bay.

It is important that we recognize the significant effects of this project on the social, economic and

environmental concerns of our community. This project involves the many issues concerning energy, balance of payments, customs receipts, viability of the bay port system, as well as the more immediate and direct effects it has on the Chevron and Port of Richmond activities, jobs and other commercial involvements.

This project has county-wide benefits in that it tends to maintain a strong tax base in the western part of the county and eventually other waterfront properties in the county. It helps to sustain the employment involved with the oil and petroleum industry and all the economic spin-offs that come from that basic source.

Our Board of Supervisors has, and will be considering in the next few weeks, a federal flood control and reclamation program -- the programs, that is -- prepared for California in the fiscal years 84-85. The San Francisco Bay to Stockton Ship Channel is included in that program.

We would appreciate if you would, during the course of this evening, explain to us how the financing of this project relates to the financing included in the tentative program. Our Board may want to prepare testimony or share with our representatives in Washington our concerns. We want to make sure that we have a good understanding of the Corps' capabilities and what their hopes and intentions are as to the timing and needs for financing in the 84-85 fiscal

year.

I and Mr. Kilkinney, who is here this evening -- he is our Assistant Public Works Director -- will follow the course of this meeting and remain in touch with the Corps staff so that we can prepare additional comments and submit them in writing to you now or before March 20th, the closing date for written statements.

In closing I want to again reaffirm the county's support for this project and to offer our assistance in keeping the project on schedule. Thank you.

COLONEL LEE: Thank you very much, Supervisor Powers.

I would like now to call on Mr. Rod Chisolm, who is sitting here beside me. Mr. Chisholm is the Project Manager for this project and he will give you an overview. He will be followed in turn by various members who will discuss the economics, the design, navigation and among other things, cost sharing.

MR. CHISOLM: The John F. Baldwin Project is a part of this larger project, the San Francisco Bay to Stockton Project.

(Slide.)

This project was authorized in 1965 and its purpose was to improve the existing navigation system between the entrance to San Francisco Bay and Stockton.

navigation opening, make a U-turn, and back down through the east navigation opening and into the maneuvering area.

The District started to look at this project pretty seriously around 1979 and we discovered a number of problems with that particular route. The first problems that we looked at were these navigation hazards, here Red Rock and here Castro Rocks, as well as the double transit of the bridge.

Chevron indicated that they do not like to move their ships on ebb tide through this particular area and had a policy that they would not allow their pilots to run that way during ebb tide. There is also a problem with a bridge height limitation on this east opening. It's only 135 feet at high tide and most of the larger tankers of 100,000 tons and above can't make it through there.

(Slide.)

The District then decided that an alternative could be provided through the Southhampton Shoal Channel, which basically comes up this way. This is a direct route to the Long Wharf, its existing depth is thirty-five feet, and it is the preferred route of the users.

The decision to go with this route basically hinges on safety in that we eliminated the need to navigate in an area of high risk.

(Slide.)

The District has been working over the last -- in this fiscal year and will be attempting to finish the final report in June, and hopefully to start construction down here in August. The project is a fairly healthy project. Under its authorized interest rate it has a BC ration of 2.7 to 1, under seven and seven-eigths -- close to what it is today -- it's 1.4 to 1.

As I said earlier, we are planning to start this project late this fiscal year and we are in the President's budget to continue construction in 1985, fiscal year 1985.

That's a brief overview of the project and I would like to turn the podium over to Mr. Lew, Our Chief Economist, to go through the Benefits Analysis.

MR. LEW: Colonel Lee and members of the audience, my presentation this evening is on the economic evaluation of the project benefits of Phase II of the John F. Baldwin Ship Channel, the provision of additional dredging in the Richmond Long Wharf area from its present depth of thirty-five feet to forty-five feet, mean low or low water.

The framework for analysis is the standard without-project and with-project conditions, with the difference between the two positions being project benefits. That is, what are the vessels and costs incurred in moving projected volumes of crude oil without a deepened channel and what costs and vessels are incurred in moving that same

volume under project conditions, that is, with a channel deepened to forty-five feet?

Now, oil companies as well as other companies have learned that there exists a potential for obtaining economies -- that is, savings -- through the use of larger vessels and combinations of vessels which can lower the per unit transportation cost. This recognition has led oil companies to take advantage of these economic efficiencies by sizing their tankers so as to minimize the their unit transportation cost.

(Slide.)

You can see from this slide that as the size of tankers tends to increase that the per unit cost, the transportation cost tends to decline. Now, obtaining efficiencies in this manner has been labeled "Economies of Scale".

But, this practice does not necessarily result in the use of the largest technically feasible ship. Other factors such as quantities needed, refinery capacity, production rates, storage cost, and last but not least channel constraints have to be considered in selecting the optimal size ship. Optimal size means generally the least cost.

Now, the project benefits and the tanker sizes were determined by use of two computer programs in the

John Baldwin Study. The first one was the Optimal Ship Transportation Model, a least cost linear type of programming model, which was originally adapted for the Deep Water Port Study and scaled down to meet the needs of the John F. Baldwin Ship Channel. The second program was the Detailed Cost Program, which handled just the peculiarities of the John F. Baldwin Ship Channel, Phase II.

Now, the Optimal Ship Transportation Model involved four steps: one, was the determination of crude oil from the various sources to refinery locations; the development of a ship cargo costs; then we developed the subroutine to take into account the peculiarities in the San Francisco Bay Complex -- and this was 55 feet at the bar and 35 feet in the interior channels, and the effect that this would have on their operations, such as use of lightering vehicles, light loading and tidal delays -- and then the identification of a fleet of vessels which overall had the least cost consistent with the various operations located along the channel.

So, this model then gave us the output for each operation along the channel all the way up to Point Edith. From this model we were able to select ships which would be used in the Phase II analysis.

So, the Optimal Ship Program provides the least cost solution but many of the types of details that we needed

for the John F. Baldwin were not available as part of its output. So, in order to identify and display those the Detailed Cost Analysis Program was developed.

The two programs were designed to work together. The distinction between the two is that the Optimal Ship, given the basic parameters such as crude oil demand, ship sizes, their costs, and channel depth determined the optimal ship mix, while the Detailed Cost Program itemizes and displays the transportation cost for any ship mix that the user selects for a particular phase and we didn't have to run the whole program in order to obtain the detailed analysis for Phase II.

So, once the optimal ships have been selected the Detailed Cost Program can provide detailed cost data for sensitivity analysis. The program is able to compute the costs for deliveries up to Richmond or El Segundo directly, off loading partially at El Segundo and coming into Richmond, and various lightering combinations in San Francisco Bay. It was this program that was used to compute the transportation savings for Phase II.

Having determined the ship sizes, we went on to make the commodity flow projections. The analysis of benefits depends upon the accuracy to which the future petroleum product use can be projected. The petroleum market has proven to be highly unpredictable since the

Now, the assumptions underlying these forecasts are steadily increasing fuel prices, increased conservation and increased feasibility of alternative energy sources. These effects must be pervasive in order to counter the impact of California's growing population and the energy requirements that this will necessitate.

So, these considerations indicate that in terms of total throughput capacity the refineries around the state will change very little. The major changes will occur in the types of crude that can be refined.

At present the crude going through the California refineries comes from three sources" California, Alaska and the Indonesian area. The Alaskan and Indonesian crude is brought in on deep-draft vessels and California crude comes in mostly through pipelines.

The analysis of the future petroleum market can be summarized as follows: petroleum is viewed as very dynamic market with offsetting trends tending to cancel each other out; the consensus appears to be for a steady market or a slight increase at least for the next twenty years.

For the particular refinery in question in Phase II, the projection is for a slight increase over the next twenty years. So, based on this information the analysis concludes that a modest one-half of one percent per year growth for

the next twenty years was considered most likely. Other possibilities of no growth, one percent and two percent were considered as part of the sensitivity test.

The projections of crude petroleum to move through the Phase II area are presented in this next slide.

(Slide.)

It shows the various sources. This is the total running from 284,000 barrels per day rising up to 294,000 barrels per day. The lower part of the table are the shipments which go to El Segundo. We don't look at those too much in looking at our analysis because that's not our primary area of importance.

(Slide.)

Now, given the quantities of petroleum that have to be shipped, that you saw from the first slide, and -- which are going to come to the Phase II area and the use of the two computer programs to determine the vessel sizes. The Optimal Transport used the following:

(Slide.)

The optimal solution under current conditions of thirty-five feet calls for the use of 140,000 ton tanker from Alaska to Richmond. It light loads at the source to pass over the San Francisco Bar and then lighters into two 25,000 DWT tankers to lighten the large tanker sufficiently to pass through the channel.

The optimal solution with the forty-five foot channel uses the same 140,000 ton tanker but then we only use one lightering operation.

For the petroleum which comes in through Indonesia we used 150,000 ton tanker which first stops at El Segundo and light-loads and then comes into San Francisco Bay for additional lightering. And with the firty-five foot channel one of the lightering operations out of that supply source is eliminated as well.

So, these optimal solutions are similar to the current operations though they are not identical. The Indonesian operation is the same with 150,000 ton tanker and a two port mode. But, the Alaskan operations use some what smaller vessels right now, one is an 80,000 and a 120,000 versus predicted 140,000 which we had used in the model. But, they still operate on the one port mode.

Now, in taking these trips and lightering operations into a cost the Detailed Cost Program was used. The total trip was divided into intervals by function, that is, time to load the ship at the source, travel time to San Francisco, delay at the San Francisco Barr, etcetera.

These intervals were multiplied by their appropri-ate cost factors and then summed for the total cost. Now, in formulating the time intervals factors such as vessel speed, fuel consumption, amount light loaded, tidal delays,

time to lighter were considered.

So, the Detailed Cost Program then computed the cost for deliveries to Richmond or El Segundo directly, offloading partially to El Segundo and then coming to Richmond, and various lightering combinations in the San Francisco Bay.

The following two slides do the following:

(Slide.)

One summarizes the cost per trip and the cost per ton with a thirty-five foot channel and a forty-five foot channel. From Alaska the savings amount to sixty-five cents per ton, or $93,000 per trip with 141,000 tons involved; from Indonesia the savings amount to $83,000 per trip, or fifty-six cents per ton with 148,000 tons involved.

(Slide.)

This table sets forth the total transportation savings on an undiscounted basis. The savings increased from $5,269,000 to $5,791,000 by 2025.

(Slide.)

This table shows the savings on an undiscounted and discounted basis. At a discount rate of 3½ percent the benefits are $5,639,000 and at 7 7/8 they are $5,538,000.

Now, the project benefits were based on what we considered the most probable future conditions. As such, a projected growth rate in crude petroleum use of one-half

percent per year was used. However, to address the risk and uncertainty a sensitivity analysis of several other levels of projections were made.

Starting in 1982 projections were made under conditions of no growth(zero), one percent and two percent peryear. So as with the base case analysis the projections of growth were made only for the first twenty years and they held constant thereafter due to extreme uncertainty of the basic parameters, such as price, demand, supply and alternative energy sources.

And since it is anticipated that the project will not induce growth, the same projections were used in the With and Without cases.

(Slide.)

And it rises from 145,000 up to 233,000 barrels per day. Down below those are converted into tons.

(Slide.)

This last table sets forth the conversion of those tonnages into average annual equivalent benefits. They range from $5,000,000 up to $7,400,000.

So, in brief I've given you an overview of the general procedures and the basic parameters used to evaluate the benefits of Phase II. This essentially concludes my presentation. If there are any questions I would be happy to answer those during the question and

answer period.

So, I will close by introducing Mr. Ken Kuhn, who is the Chief of our Design Branch. And he will give you the design considerations in this particular project.

COLONEL LEE: Does anybody need question sheets and not have them? If so, raise your hand and we'll get you some.

MR. KUHN: I'd like to cover some of the general design considerations that we used in the process of formulating this project and I would also like to cover some of the cost estimates that are used in the project.

(Slide.)

This slide shows an overview of the entire project. This is the alternative that was rejected that Rod spoke about. This is the alternative that we are going to discuss.

The project consists of the entrance channel across Southampton Shoals with an existing width of 600 feet. This will be deepened from minus-35 feet to minus-45 feet. At the lower end we will be flairing out the channel and it will meet the main ship channel and it will be deepened to forty-five feet out in the deep water into the main ship channel.

At the upper end we also will flair the channel approximately 1000 feet down from the existing channel end,

cut in the vicinity here. This flairing at the upper end will not only improve the access into our maneuvering area but will also improve the access into the Richmond Inner Harbor, which comes around here.

(Slide.)

This is the maneuvering area. It will remain in its basic configuration, but it will also be deepened to minus-45. At a waterways experiment station they have conducted a simulation study which has verified both the dimensions of the entrance channel and the maneuvering area. And their presentation will follow mine.

(Slide.)

The minus-45 deep project will accomodate tankers drawing about 45 feet of draft or tankers with up to 45 feet of draft, given a five foot tidal advantage. The following slide illustrates the factors effecting channel depth.

(Slide.)

There are basically four factors. First of all, the draft of the vessel, the squat of the vessel, the trim and the safe clearance. Squat is defined as the lowering of the water surface due to the increase in velocity past a ship causing it to be lowered with respect to the bottom. The amount is dependent on speed of the vessel, characteristics of the channel and vessel, and interaction with another vessel.

For our design vessel in the channel it was computed to be one foot for the squat.

The trim is the difference between the draft from the bow to the stern and is controlled by the loading of the vessel. And for our design the vessel trim is two feet.

The safe clearance is a two-foot clearance to avoid damage to the ship propellers from sunken timbers and debris and avoid fouling of the pumps by bottom material. You can see that the total of these four parameters, the draft, the squat, the trim and safe clearance is forty-five feet.

So, you can see that a tanker with a draft of forty feet fully loaded would be able to navigate the channel in the maneuvering area safely most of the time.

(Slide.)

Since the navigation conditions are poor, the Bay Pilots and the Coast Guard recommended that the channel be limited to one-way traffic. With an average of six ships per day traveling into and out of the Richmond Long Wharf and the Richmond Inner Harbor, congestion is not considered to be a problem. Two hours is the maximum expected delay.

With poor navigation conditions a factor of two-hundred percent is used to determine the maneuvering area width. It is the width that a Pilot would need under poor conditions to keep his vessel on a straight line, or near

to a straight line. This results in a three-hundred foot width.

Bank clearance is one-hundred percent of the beam and this reduces the danger of hitting the bank or grounding, which results in 150 feet on each side for a ship with a beam of 150 feet. This results in a total channel width of six-hundred feet.

(Slide.)

Approximately eight-million cubic yards of material will be dredged between the existing maintained depth of minus-35 feet and the authorized depth of minus-45 feet. The cost is based on dredging by clamshell dredge with disposal at Alcatraz by barge and scows.

The disposal site is approximately seven miles from the project. Cost is based on a four-year construction period and the price levels are at November, 1982 prices. This table shows a preliminary cost estimate, this is not a final cost estimate. We will do a government estimate before we go to bid.

And, Item 1, Mob and Demob -- the dredging itself at the maneuvering area, almost four-million yards at unit cost of $3.95. The entrance channel, Southampton Shoals Channel, almost four-million yards. You can see that it's almost evenly divided.

With contingencies, engineering and design, and

the navigational aids that the U.S. Coast Guard will put in, we have a total of almost $42 million, which is a total federal first cost.

(Slide.)

The non-federal cost is for dredging a berthing area to minus-50 feet adjacent to the Long Wharf. This will be the responsibility of Chevron Oil Company. The area is 125 feet wide by 3700 feet long. For the purpose of this cost estimate it was assumed that this dredging would be incorporated into the federal contract.

Thus, the mobilization and demobilization becomes a minor cost item simply involving pro-rating the total project mob and demob. See, we use the same unit cost for a quantity of 275,000 cubic yards total with contingencies, E and D, of about 1.5 million.

That concludes my presentation and I would be happy to answer any questions during the question and answer period. I would like to introduce Karl Huval from Waterways Experiment Station who will talk about their simulation study.

MR. HUVAL: I'm from the Waterways Experiment Station, the chief R & D laboratory for the Corps of Engineers. We're located at Vicksburg, Mississippi and we were set up initially back in the early 1930's as a part of the country's effort to help control the 1927 flood. And

we've grown since then to a variety of things.

The study we had underway was started about a year ago, about May or June of last year, and involved the implementation of the Baldwin Project Channels in a ship simulator, which is very similar to aircraft simulators only this is for ships.

So, we will go through some slides and I will talk a little about each and we'll present some of the results of our simulation.

(Slide.)

Okay, this is the project area. And the main thing I want to call your attention to is the various features involved. Here is teh Southampton Shoal Channel, the Red Rock is located here, and the bridge, and the Long Wharf here. And these dots here indicate the different navigation aids.

Each one of those was put into our simulator exactly as it is in real life. Our simulation area involved roughly this lower boundary of the slide and this upper boundary of the slide and included the navigation aids here up to the entrance channel here. So, we will go on to the next slide.

(Slide.)

Okay, this is the same view only you're looking now south. It is an actual simulation on our simulator,

the radar view. This is the ship right in the middle of the slide, just like the normal ships have in real life. These various dots are the various navigation aids and this is the coastline of the area involved, this is the Long Wharf, and this is the San Rafael Bridge.

And the line here is the projected course of the ship as they have it on the radar images on the ships. We went out to the scale model, which is located right here in this building, and visited it when we were in the vicinity back in June. We took a picture like this and we looked at the tidal currents..

And since then we have asked John Sustar, who is incharge of the model here in the District, to furnish us with current measurements located at various locations in the project area. These current measurements were used to generate this distribution of currents as you see in this slide.

(Slide.)

This is the Southampton entrance channel, this is the maneuvering area, this is the Long Wharf. These little lines indicate the magnitude of the currents and the angle of the current as well. So, for example, the ship coming in towards the Long Wharf is coming in this way and is feeling a cross-current in this direction of about something on the order of fifteen degrees.

(Slide.)

These are the ships that we modeled on our ship simulator: the Chevron "California" is typical of the ships that are now calling at the Long Wharf. It comes in at a partial loaded condition, it's a 70,000 dead weight ton tanker, its length is roughly 800 feet, 105 foot beam, and the draft is typically on the order of 28.5 up to perhaps 32 feet, depending on the tide.

This ship if it were fully loaded could be drawing as much as 42.8 feet. Our simulated ship was also partially laden. We used a slightly larger ship than the "California". It had a length of 760 feet, its beam was 125, its draft was 29.5. And its full draft would have been forty feet.

So, you see the two are quite comparable and reasonably close to the simulation, close to the real ship. The Chevron "H.J. Haynes" was chosen as the kind of ship that's going to be typical of those hauling after the project is in place. It's to be a 150,000 dead weight ton tanker, its length is roughly 900 feet long, 160 foot beam, 40 foot draft, and it would draw 52.8 if it were fully loaded.

And our simulator-design ship is also partially loaded, it's also 150,000 dead weight tons, it's slightly longer and the beam is slightly smaller, its draft is 40 feet.

So, these were the ship sizes that we used in our

simulator.

(Slide.)

Okay, we also came out here in June and got onboard the California and went on a run all the way up into the Bay right from the ship's bridge and watched and talked with the Pilot as he was coming in. We also videotaped this inbound transit. And this is a still photograph of the area involved onboard the ship. This is the Chevron tanker getting close to the docking position at the Long Wharf. This is another ship docked at the area.

(Slide.)

From this we constructed our ship simulator. This is the video screen of the simulator. This is the ship very similar to the "California", and this is the Long Wharf, and this is the Administration Building in white here. You might not be able to see it in this, but there is a gas tank in the background. And this is the sloping hills in the area.

(Slide.)

Okay, this is a view of the simulator. This is the bridge, the ship control console, this is the wheel of the ship, there is a rudder angle indicator, a course indicator and a rate of turn indicator all located on this console. This is that radar image I was talking about and this area here indicate various other parameters such as the

course, the heading, the speed, the wind, and several other parameters that the Pilot needs to use to run through the project area.

This is a Chevron Pilot, he came out to the simulator for a day about a week ago and he is there piloting the ship going around through the maneuvering area towards the Long Wharf.

(Slide.)

We ran several runs with this configuration. Pilot A and B were two of our own Research Engineers who actually conducted a lot of the tests and conducted the tests with both the existing-type ship and the fully loaded-type ship. And we had a number of different trial runs, as you can see, something on the order of twenty-five or thirty runs total.

We ran tests with the base condition, we deepened the channel, we used bigger ships, we also ran with flood tide and ebb tide conditions. We also ran some container ship tests, and I will talk about that a little bit later.

(Slide.)

Okay, here are some of our ship tracks that we made coming into the Long Wharf. This is flood tide, the deep test, and the base test condition. This was with the typical of the ships calling now at the Long Wharf, loaded to about 29.5 feet, coming around and getting lined up with the dock. And here it is with the deeper and bigger ship.

(Slide.)

This is some of the data that we were getting out and using to study to make determinations about the safety and adequacy of the maneuvering. For example, this is the rudder angle that's used by the ship. For example, here the ship is using thirty-five degress right rudder. This is the main turn that is used to enter into the maneuvering area by the Pilots. And this is with the deep test and this is with the base test.

So, I'll just go through these and show you the kind of data that we used for each one of these test runs to give us an indication of how the maneuvering is going, hos safe and how reasonable the moves can be.

(Slide.)

This is the docking speed at flood tide for the base test conditions and the deep test conditions. And this is the actual speed of the ship, and this is the actual speed of the ship for the base condition and for the design condition.

And these are the transverse speeds at the bow and at the stern of the ship. So, the idea here is that if the ship, when it gets to the point where it is close to the dock, is in the position that it's going at very little speed and with hardly any movement in the transverse direction then we can say that the ship is in a reasonably

safe docking mode and then the tugs can get ahold of the ship, push it into the dock and the ship can be made fast to the wharf.

(Slide.)

Okay, this just shows some additional data very similar to the other. This is, for example, the angle that the ship is in in relation to the dock.

(Slide.)

We also ran some ebb tide, and I just thought I would show you some of those. This is the base test condition with the ship going around the point and angling itself up so that its bow is always into the current to gain the best control of the ship through the maneuvering area.

This is with the larger ship. One needs to go higher up to start this maneuver and then slide into the dock. Here the ship is a smaller ship and you can actually turn it around with the current in the stern of the ship and turn it back ar und, getting it lined up with the dock in a reasonable safe manner.

(Slide.)

Okay, this is one of the runs that we did with the container ships going up around and making the turn around and getting up, lining up, and going back towards Richmond Harbor. The intent here was to study the effect of the new

channel on possible -- any adverse effects that the channel might have on the container ships going around the point and getting back into the Richmond Harbor.

And, as you can see, the maneuver is reasonably safe and fairly easy to accomplish with that size of container ship.

(Slide.)

These are some of the things that we found that needed to be looked at a little bit more carefully in terms of what might be needed in potential changes in the design, both in terms of possible dredging saving costs and improving the possible added safety to the project.

This area here was initially recommended as a possible area that might be dredged. In discussing it with the Pilots since that recommendation the Pilots have felt very strongly that this is not necessary, that if a ship ends up in this area she's in trouble anyway, in the words of the Pilot.

So, this cut here was also a potential add-on to the project and that was decided that that part of the recommendation properly belonged to the Richmond Harbor Project.

This is the proposed cut of the nose as proposed by the District, and it seems reasonably safe. And that is probably what is going to be constructed.

Okay, this ends my presentation, and like the other speakers I would say that I would be happy to answer any questions during the Q and A session later on. Next we will have Mr. Jay Soper who is going to present some information about the dredge disposal.

MR. SOPER: The dredge disposal for this project is to be at the Alcatraz Disposal Site and there have been some recent concerns expressed over the disposal site. And tonight I would like to talk a few minutes and address those concerns as we see them.

Briefly, I'm going to go through the history of the disposal site, the problem or the concerns that we recently ran across, the actions that we've taken to address those concerns to date and proposed actions that we've proposed to take in the near future.

(Slide.)

Just to refresh your memory, the Alcatraz Disposal Site is located just off of Alcatraz Island. It is 1000 feet in diameter and its average depth is about 90 feet. While I have this slide up I would like to point out one of the contributing factors to the current problem.

Apparently the crews that have been using the disposal site have been lining themselves up with a landmark both on Alcatraz and one on San Francisco, which caused them to be dumping all of their loads in the identical same spot

within the disposal area instead of distributing their dumps throughout the disposal area.

(Slide.)

First, a little bit about the history of the site. The Alcatraz Disposal Site has been used as a dredge disposal site for over fifty years and up until the early 70's there were eleven different areas in the bay used for dredge disposal.

In May of 1972 Alcatraz was designated as one of the five approved dredge disposal sites in San Francisco Bay. It is not one of only three approved disposal sites in the bay. Since 1972 approximately three and a half million yards have been dumped at the Alcatraz Disposal Site annually. About two-thirds of this material is through Corps dredging operations and the other third is done under Corps permits by private concerns.

The site itself has a volume of about five-million cubic yards below the minus-40 foot level, that's from the 40 foot to the 90 foot. And it is commonly believed that the majority of the disposal material that is dumped at Alcatraz is carried out through the Golden Gate because of the high velocities through this disposal area.

(Slide.)

Now a little bit about the problem. [illegible] successfully performed throughout its fifty year history [illegible]

until late in 1982 there was no evidence of accumulation of material within the disposal site itself. Ub November of 82 a mound was discovered that extended into the navigation lane. The mound had a top elevation of minus-24 feet and contained a volume of approximately 800,000 cubic yards.

(Slide.)

This is a contour map of the disposal site. As I said, the disposal site is a 1000 yards across, and you can see the mound is located in about one-sixth of the disposal site. And the peak itself shows up as a very small area in relationship to the total disposal area.

(Slide.)

Now, what was the cause of the mounding? There are several reasons, we feel. It was determined that the mound was an anomaly from a combination of these circumstances. The material was apparently new work dredging by private contractors under Corps permit. The material was apparently dredged by clamshell and contained such items as boulders up to eight feet in diameter, reinforced concrete, and large chunks of natural bay mud.

And as I previously pointed out, the barges were aligning themselves in such a manner that all of the material was being dumped at the one location.

(Slide.)

What have we done about it? We have notified the

permitees and the dredging contractors that only sediments are allowed to be dumped at the disposal area and that they must now restrict their dumping to the western half of the disposal site.

We notified the bar pilots and arranged for the Coast Guard to mark the site as a navigation hazard. We initiated a monitoring program to see what is happening to the mound and to the remainder of the site. We have coordinated with all the interested groups and agencies, and I would like to note that they generally agree that we should continue the use of the Alcatraz site.

The size of the mound has decreased since we stopped the unauthorized dredge disposal activities and required dumping to be limited to the western half of the site.

(Slide.)

This is a graph that shows the volume of the site above minus-50 foot contour. When we first discovered the anomaly, the mound, our initial survey showed that there were 240,000 cubic yards of material above the minus-50 foot elevation.

By taking the actions we did, by causing the users of the disposal site to dump in the western half of the site, and to eliminate any further debris being included in their disposal, the natural currents and the natural eddies in the

bay have reduced that volume.

We survey this monthly or every two months and out latest survey in January shows that the volume above minus-50 has dwindled down to 138,000 cubic yards, approximately. The problem is that the peak itself has not come down very much.

So, the mound is getting smaller in volume but the height is about the same. And we attribute that to the debris that's in the mound itself. We propose to remove the top of the mound down to minus-40 feet and we are presently preparing plans and specifications for a construction contract to do that.

We propose to haul the debris that we take out of that mounding to a land disposal site and we will redistribute the acceptable sediments within the other areas in the Alcatraz Disposal Site.

(Slide.)

Some of the things we're going to do: We propose to develop a contingency plan in the event that the new work disposal causes further accumulation. That plan includes the possibility of limiting the type of dredging, time of disposal, and also the potential of alternate in-bay sites.

We have completed initial tests on the Bay Model which looked at the velocities and flow patterns through several areas, both in the Alcatraz Disposal Site and from

there to the Golden Gate. We will be verifying the model with some actual velocity tests in the bay itself very shortly.

We are developing a long range monitoring program and we are reviewing the dredge disposal policies that are currently being used. When we complete the plans and the specs for lowering the mound we will be requesting construction funds to actually go in and remove the mound.

And we will continue to coordinate with the interested agencies and groups to keep them apprised of exactly what's happening out there and what we're doing.

I'd like to summarize again that we feel the problem is an anomaly caused by the large pieces of unauthorized debris and that with the controls we have already implemented the site will perform successfully. If it is not an anomaly but a gradual accumulation the mound still represents less than two percent of the total material disposed of at Alcatraz over the past twelve years.

And at that rate of accumulation the site still has a capability of handling over two-hundred-million cubic yards of disposal below the minus-40 foot contour. That's all I have for right now and I, too, will be happy to answer questions during the question and answer period.

Right now I'd like to turn the podium back to Mr. Chisholm to discuss the environmental aspects of the project.

MR. CHISHOLM: The project area -- I think this is a great slide --

(Slide.)

-- because it shows that we're not in a very environmentally sensitive area -- but the project area is basically a port area. It has been the subject of two EIS's. One, the Richmond Project covered the entire area and the Outer Richmond Project, including the Southampton Shoal; and then the EIS that accompanied the design memo we just put out.

The Corps coordinated with the U.S. Fish and Wildlife Service and the Department of Fish and Game under the Fish and Wildlife Coordination Act and we received a planning aid letter from the Fish and Wildlife Service which described the resources in the Long Wharf area and channel area. And basically they said that there wasn't anything too special there.

Basically, an area of migration route for anatomous fish, some indigenous bay species use the area, and some seals use the area up here in Red Rock.

The Richmond Richmond EIS showed that there was relatively few cultural resources out in the project area and an analysis of the air quality in not only the outer harbor area but also the entire Richmond area was determined to be "good".

So, what are the environmental issues? In 1980 the District held a scoping meeting to discuss what environmental issues should be highlighted in the EIS and from that scoping meeting we developed the significant resources that the public wanted to see us evaluate out alternatives against.

These significant resources were: water quality, benthos, navigation and energy. I'll address the first two; since the project has a positive effect on navigation and energy, those more or less dropped out as issues.

(Slide.)

Working with the EIS and looking at all the information we had on water quality and benthos, it all turns out to center around this operation of dredging and disposal. The District ran elutriate analysis and bioassays to determine if the material was acceptable for disposal at Alcatraz, and it was found to be acceptable.

The effect on benthos was more or less common to all of the dredging projects: short-term loss due to the dredging, short-term loss at the disposal area due to smothering, but then a recovery in the area two or three years down the line. This was not considered to be a significant impact in that these areas are dredged areas and we weren't going to be doing very much dredging in the virgin bay bottom.

Okay, so those two issues as far as dredging, at least for us, not too much of a surprise. The issues of the cumulative impact on the bay of all dredging in the bay is another question.

I think at this time the only thing we can say the alternative to that is is no project. If a decision is made that we don't want to add to the cumulative impact of dredging and disposal in the bay we would have to say no project.

There are some environmental benefits that come from the improving of the efficiency of the system. We feel that there will be a lessening of the traffic of tankers, especially in prefunctory area around Alcatraz which is a fairly dangerous area. That's because the ships would not have to go down to Anchorage No. 9 and be lightered and then move up to the Long Wharf.

We also think that we have eliminated some safety problems, especially around the Richmond-San Rafael Bridge. And the fact that there would be less lightering as a benefit of this project -- these three things: traffic, safety, and less lightering point to us as the lessening of the potential for oil spills in San Francisco Bay.

I will answer questions. But, before I do that John Eft is going to talk about cost-sharing.

MR. EFT: Well, I've got one more pretty picture

for you.

(Slide.)

But, my subject is one that can't be shown in a picture, because the first thing that has to be said about cost-sharing is that there isn't any, except with the minor exception of the berthing area. And how we got there, how we got where we are, is a story of history. And I'm going to give you the history so you know how we got where we are.

I'm going to go back to 1965. In 1965 the Secretary of the Army sent a report from the Chief of Engineers to the Speaker of the House proposing this project and the Chief of Engineers recommended that no cost sharing be required for the project. The Secretary also enclosed some comments that were made by the Bureau of the Budget, which was the predecessor of the Office of Management and Budget now, in which the Bureau of Budget commented on the Chief's recommendations and noted that the maneuvering area around the Standard Oil dock apparently was used only by vessels calling at Standard Oil.

And therefore the Bureau of the Budget recommended a study and recommended no construction until this study done by the Army. And the subject was to be whether there was only single beneficiary and therefore whether there should be local cost-sharing. The local sponsor in the

Chief's report was Contra Costa County.

The Bureau of the Budget recommended fifty-fifty cost-sharing by the local sponsor if this study found there to be a single beneficiary only in the project. Well, in the Secretary of the Army's letter the Secretary noted the Bureau of Budget comment and he agreed to do the study and said that fifty-fifty cost-sharing might be appropriate if the study shows there is a single beneficiary for this part of the project, but that the project should be authorized anyway.

Well, at one point about 1973 the San Francisco District did begin an investigation of that question and concluded essentially that indeed there was a single beneficiary. But, there are other ways of looking at that, too, if you look at the whole project and all of the phases together then this phase is potentially usable by other beneficiaries.

But, the point that we want to make is not to redo that study but to look at what Congress told us, because I think that's the controlling question. We do have an answer on the question from Congress about what we're supposed to do in cost-sharing.

So, about 1975 the Corps of Engineers began looking more closely at the legislation, how it got where it was. The first thing we had to look at was the Senate Committee

on Public Works, their Report No. 464 in 1965. And this was the report that accompanied Senate Bill 2300. That was the Senate version of what became the Rivers and Harbors Act of 1965.

And it said in the Senate Report: "Prior to request for funds to initiate construction of that feature of the project" -- "that" being the maneuvering area around the Standard Oil dock -- "for enlargment and deepening to forty-five feet the Committee desires that the Chief of Engineers restudy the matter of cost-sharing and advise the Committee concerning potential additional users of this waterway together with his recommendations for cost-sharing. The Committee desires to make it clear, however, that this restudy is not intended to delay prosecution of the remaining features of the project."

At about the same time the House Committee on Public Works was preparing its House Report No. 973. And that was the House's comments on Senate Bill 2300. The House Committee carefully noted the Bureau of the Budget comments on the maneuvering area, it carefully noted the Secretary of the Army's comments, and it went on to note the "close functional relationship" -- as it put it -- "between the maneuvering area and other project features". And it said that all of the project features were considered necessary for safe and efficient navigation.

And therefore the Committee said: "The Committee considers that no special benefits will accrue and that the local cooperation required by the Chief of Engineers is appropriate without necessity for a subsequent finding by the Secretary of the Army."

Well, we obviously had a conflict between the two houses and this conflict led to a Joint Senate-House Conference Committee. And the result of the Conference Committee can be summarized in their report: "The Committee of Conference on the disagreeing votes of the two houses on the amendment of House Bill S-2300 authorized in the construction, repair and preservation of certain public works on rivers or navigation and flood control", and so on, "having met after full and free conference have agreed to recommend and do recommend to the respective house as follows: That the Senate recede from its disagreement to the amendment of the House and agree to the same."

In other words, the Senate backed off and accepted the House position, which was no cost-sharing. So, the Rivers and Harbors Act of 1965 was enacted and the language that was enacted was: "The following works of improvement of rivers and harbors and other waterways for navigation, flood control and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army at supervision of the Chief of

Engineers in accordance with the plans and subject to the conditions recommended by the Chief of Engineers in the respective reports hereinafter designated."

And the report was the Chief of Engineers' Report that I referred to earlier, which contained no cost-sharing. Notice that it said "in accordance with the Chief's Report", not in accordance with the Bureau of the Budget's comment or the Secretary of the Army's comment.

And incidentally, in other projects authorized in the same act they did adopt some of the conditions added by the Secretary of the Army, some of the conditions added by the Bureau of the Budget.

So, we conclude that no cost-sharing is necessary because Congress deliberated it very carefully and has told us that there should be no cost-sharing for that part of the project. And our opinion there was confirmed by the Chief of Engineers in 1977.

That's how we got where we are in cost-sharing. And I will, of course, answer any questions in the question period.

Colonel Lee?

COLONEL LEE: Thank you very much, Mr. Eft.

I sometimes give a briefing to various agencies. I call it my Kiwanis Club Briefing. It contains a slide showing how the average length of a Corps project from start

to finish is fifteen to twenty years. I should precede that slide with John's dissertation on this item here. That helps explain, I suppose, why it takes so long.

At this point I would like to give an opportunity to members of the audience who would like to make a statement before we get into the question answering session. I have two cards at the moment from people who have indicated they would like to make a statement.

I would like to call first on Mr. Norris Milliken, who is a Staff Engineer of the Bay Conservation and Development Commission.

STATEMENT OF NORRIS MILLIKEN

Thank you, Colonel Lee.

I enjoyed the presentation so far. My name is Norris Milliken, I'm the Staff Engineer of BCDC. And I just wanted to make a couple of statements, mostly just to get on record.

BCDC considers the project within BCDC's permit jurisdiction and in that it is a federal project, then, pursuant to the Coastal Zone Management Act the Commission must find the project consistent with the Bay Plan and the McAteer-Petris Act.

I don't have a full list of issues that they may be considering, but generally speaking I think the issues involved that the Commission will look at are basically the

dredging, most specifically the dredge spoils at the Alcatraz site.

Also -- and I don't know that this appl... this particular segment, but in the other segments ... the Commission at the time of other comment peri... very interested in the null zone, the mix of the ... water-fresh water wedge, and where if that is aff..., and if it is affected what impact that might have.

So, basically they would be concerned with ... the fresh water-salt water implications of the pr.... Thank you.

COLONEL LEE: Thank you. Mr. Mill....

Next, Mr. Frank Boerger representing ... California Ports and Terminals Bureau.

STATEMENT OF FRANK BOERGER

Thank you, Colonel Lee.

Members of the Corps of Engineers, ... gentlemen, I am a Consulting Engineer who ... for providing advice to the Northern Californ... Terminals Bureau. Before I make my remarks ... what that organization is.

It is a non-profit corporation ... of the eight ports in the bay/delta area. ... public ports: San Francisco, Redwood City, ... Sacramento and Stockton. There are two ...

Port of Encinal in Alameda and the Port of Benicia.

These eight ports have gathered together to provide a regional approach to port activities, and therefore we are very interested in this project and in all projects thatcontribute to maintaining the viability of the port system of the Bay Area so that it can remain competitive with other ports on the West Coast and in the United States.

So, therefore we strongly support channel deepening projects that can affect beneficially those ports. And even though the ports are competitive between each other and among themselves, they still believe that it is important for all of them to pull together in order to maintain an adequate port system.

Another associate member of Nor Cal is the Contra Costa County Development Association, which therefore represents in an indirect way the five refineries in Contra Costa County and the other industries that are located along this channel that use the seaways to bring in or ship out their various products.

So, consequently we're interested in the continuing development of channel depths in order to support these industries because of the interest of the Contra Costa Development Association.

I think that there are just three points that I would like to make very briefly. And they involve the

environmental issues, the economic issues and then the overall project situation. First, environmental issues: We think -- and I'm glad to hear what Mr. Chisholm said -- that there are some very important environmental benefits to this project that are many times overlooked because we generally look at the problems involved in the dredging and the deepening and so forth without realizing the many gains that can be made.

Now, these environmental gains that Mr. Chisholm mentioned are the fact that we can allow ships to come into the bay and proceed directly to the port rather than having to wait for tides or to anchor for lighterage. And therefore we can reduce the amount of times the ships are in the harbor and the amount of extra energy that they have to use.

And we think these important environmental steps forward should be considered by all agencies in evaluating the Environmental Impact Statement that has been prepared and in their approach to the whole project.

The second point on economics is that this channel deepening will be of incremental help in the approaches to the Port of Richmond and eventually to the Port of Benicia. And I heard no mention tonight of the advantages to these ports for deeper shipping for container ships or other kinds of bulk cargoes that may go to the ports because they were not calculated into the benefit that

I heard discussed tonight.

And that's just fine. But,the point is that there are some additional benefits that will be gained as these other projects come on-line and are developed and that those benefits will be important to the port system as well as to the individual private terminals that we've been talking about tonight.

The third point has to do with the overall project. I heard earlier that the channel deepening through the west opening under the San Rafael Bridge was rejected in this Phase II. I hope that doesn't mean it's being rejected for the rest of the project, because it is very much needed in order to provide the same kind of access to the other five refineries, both in Contra Costa and in Solano County upstream that is required for the long wharf of Chevron.

And that portion of the project, of course, is in the next phase. But, it is one that we should not leave out because it can be very important. There are other facilities up there that will also take advantage of that. In the last ten years there have been two new gasoline receiving facilities built that in effect have had the environmental effect of moving the refineries offshore, or at least out of the Bay Area, and many people in the Bay Area appreciate that.

And the point is that those gasoline receiving terminals can also then be able to accomodate larger ships, even as the refineries can accomodate larger crude ships. And that will, again, be another additional benefit that we can see down the line.

So, we tend to look at these incremental improvements in the overall system as very important. We want to congratulate the Corps and the County of Contra Costa for continuing to move on this project and we're very happy to see that progress is being made and look forward to seeing the remainder of the project completed at an early date. Thank you.

COLONEL LEE: Thank you, Mr. Poerger.

Are there any other members of the audience who would like to make a statement?

(No response.)

Very well.

At this point we have scheduled a twenty-minute break, but given the relatively small size of the audience tonight, I'm anticipating not too many questions. What I would like to do instead is take a ten minute break, enough to use the facilities and hand in those questions you have. If we need more time we can take it, but I would like to schedule no more than ten minutes.

So, by 9:15 on the wall clock, if you would, be

back. In the interim please turn in your questions to Rod Chisholm at the front table. If you would like to visit the restroom, it's back out the door you came in across the breezeway outside.

So, we'll see you back here at 9:15.

(Whereupon, a ten minute recess was taken.)

Okay, we will resume with four questions we have. First, is a question on economics for Mr. Lew.

MR. LEW: This is a question from the Oceanographic Society by Gary Gray. He asks: What are the actual projected yearly savings of transportation cost from deepening?

The yearly transportation costs from deepening in 1985 based on given volumes amount to $862,000; in 1995 they are $1,630,050; and for the period 2005 to 2035 they are $3,117,000. So, the total is $5,639,000.

Now, even if you used the no-growth case they range for the project life from $5,000,000; and if you use 1/2 a percent that we use it's $5,600,000; the one percent is $6,200,000; and the two percent is $7,4[illegible].

Now, the savings don't amount to very much on a per ton basis, it's only sixty-five cents per ton [illegible] from Alaska and fifty-six a ton coming in from [illegible]. But, the volumes are very large so that's why the savings run up into the millions of dollars per year.

COLONEL LEE: Does that answer your question, [illegible].

Gray?

MR. GRAY: No, it doesnt.

THE REPORTER: I won't be able to hear you. Would you please come to the front?

COLONEL LEE: Speak into the mic, if you would.

MR. GRAY: Thank you, gentlemen?

All right, what is the overall factor through the year, I think, 2035? I wasn't sure whether you said $8.6 million over the whole term or $5.0 million over the whole term.

MR. LEW: Okay, over the whole term the average annual equavalent benefits are $5.6 million. Which means that over a period of time they build up, you see, based on the different quantities.

But, if we just use the projections that were used in the project justification, if you want the benefits on the non-discounted basis --

MR. GRAY: Well, here is what I'm puzzling about, is that the project costs $43 million --

MR. LEW: Right.

MR. GRAY: -- and the savings sound like they are only $5.6 million. Am I thinking along the right track or is --

MR. LEW: No, see the savings on an average annual basis over the life of the project amount to $5.6 million

a year.

MR. GRAY: Yes, that's what I wanted.

COLONEL LEE: You annualize both the costs and the benefits.

MR. LEW: They're annualized.

See, the costs and the benefits are annualized. So, the project costs $41 million dollars over the fifty year life, so the annual cost is probably on the order of $1.6 million per year. See, it's like buying a house, when you amortize the house over the life of the house you only pay like maybe six or, seven-thousand dollars a year.

MR. GRAY: So, what is the forecasted total, though?

MR. LEW: Oh, you mean -- that would be fifty times that, then. So, you're talking on the order of $250 million.

MR. CHISHOLM: Undiscounted.

MR. LEW: Undiscounted.

See, if you wanted to sum it all up at the end -- I just don't happen to have the factors here -- it's a rather large number. Rather than taking it year by year, if you wanted to accumulate it all you just multiply it by fifty and then the averages on top of it.

(Pause.)

These are economic concepts in terms of the average annual equivalent benefits which the lay man may not

understand.

MR. GRAY: It shouldn't be complicated.

MR. LEW: It's not.

COLONEL LEE: Next we have three questions on environmental issues -- or two questions -- which Mr. Chisholm will address.

MR. CHISHOLM: The first question is from Bob Tasto. Bob is with the Department of Fish and Game. Bob's question is: Is the use of an alternative dredge material disposal site being considered in light of the Alcatraz problem? If so, what is the status of that alternative site?

Mr. Soper doesn't want to answer it. No, we are not considering an alternative site. We are, of course, trying to find out the problem at Alcatraz a little more and also we're doing some studies in the Golden Gate area to locate other high energy areas with a predominant ebb current on the bottom.

You can talk a little more about that with Mr. Sustar who is running those studies here at the Bay Model, if you'd like.

MR. TASTO: Could I supplement that question?

THE REPORTER: Please come to the microphone.

COLONEL LEE: You have to come up and do it at the mic there, if you would.

MR. TASTO: Okay.

COLONEL LEE: We don't encourage debates but we're happy to accept clarifying questions.

MR. TASTO: Yes, this is just a supplementary question. When Rod mentioned ebb tide a thought came to me, a question that I had failed to ask and maybe I can ask it at this time.

COLONEL LEE: Go ahead.

MR. TASTO: It's my understanding -- I haven't had a chance to review the Draft EIS -- there has been some consideration to the disposal of the eight-million cubic yards at Alcatraz to an ebb tide situation only. And my question is: Is that under consideration, has a determination been made at this point in time whether or not you will go through with that or has it been determined that that is not a feasible alternative?

MR. CHISHOLM: The status of that -- well, let me go back to the start of that. In the Fish and Wildlife Coordination Act Planning Aid Letter from U.S. Fish and Wildlife Service their recommendation was to minimize the impacts of the dredging and disposal that we implement ebb tide only disposal.

We evaluated that in terms of the cost to us and it adds about $3.7 million to the project. The feeling between both the District and in consultation with the

Division Office was that before we spend that kind of money we needed a little more detail on what the environmental benefits would be. And we have gone back to the U.S. Fish and Wildlife Service and asked them for a special report detailing the environmental benefits of ebb tide disposal.

That report is supposed to be to us by the first of March and will be included in the final report. So, right now we are sort of waiting on that. The clamshell and barge operation we report is basically the way we're going to go at this time.

MR. TASTO: Thank you.

MR. CHISHOLM: Okay, I have two questions from Gary Gray of the Oceanic Society. The first one is: A recent Appellate Court case requires that cumulative effects, in this case dredging, must be considered. Does this kill the project as Mr. Chisholm indicated?

The cumulative impacts question has been addressed somewhat in the bay by the composite EIS or maintenance dredging. Now, this is not maintenance dredging, but we also conducted a study back in the late 70's called the Dredge Disposal Study, which attempted to look at the effects of dredging and disposal on an area-wide basis within the bay

The Corps, I think, believes that the bay can

handle the disposal. Now, what other people believe about that is certainly a subject for a lawsuit, I suppose. John might want to address that, John Eft, our Counsel.

COLONEL LEE: Before he does I'd like to ask for a clarification of that question just so that I can -- and maybe others -- understand it better.

When you say "cumulative effects" what are you speaking of? Which particular effect of this dredging? The effects of disposal or the effects of the loss of benthos at the site where it's being expanded a bit, or what?

(No response.)

Because he indicated that such effects as were appreciable were short term, lasting only several years, and then the benthos revitalized itself.

MR. GRAY: What the case referred to was the immediate effects of the project, which in this case, I believe, would be the dispersal and the dumping of the dredged material. This case, I've noticed, came down in the last week or so from either the California Supreme Court or the Court of Appeals for the Ninth Circuit, which includes California.

I'm a business lawyer, I'm not an environmental expert. But, I'm familiar with environmental law and if I was the General Counsel that certainly would stick in my mind. So, that's the specific: the immediate damage from it.

Or, the effect. It may not be a damage, it may just be an effect.

COLONEL LEE: Well, if it's come down in the last week I'm not sure our Counsel has had a chance to analyze it. Do you want to say anything, John?

MR. LFT: Yes.

I don't know the particular case, but there is a long line of cases that requires that requires that agencys look at cumulative effects. We certainly acknowledge that responsibility under the National Environmental Policy Act, that's a well-established requirement.

And I would say that -- well, Rod has already addressed the cumulative impacts in maintenance dredging -- but, to the extent that we've studied the disposal site at Alcatraz we have by definition studied the cumulative effects of all projects that involve disposal at Alcatraz. So, if you are talking about the cumulative effects on the dredging site and suggesting we should cumulate, for example, Redwood City and Richmond and Stockton or wherever, you know, that's a judgment call, how far apart in time and geography those effects should be accumulated in a NEPA discussion.

But, as far as disposal I would say that we have, by looking at the Alcatraz -- the cumulative effects of disposal at the Alcatraz site. But, you're absolutely right, we do have a responsibility to look at the cumulative

effects.

COLONEL LEE: I'd like to elaborate on that a little. If it turns out the way we think, we don't envision that the effects of this new dredging disposal at Alcatraz will be any greater than the cumulative effects of the maintenance dredging at Alcatraz. Which, as he said, has already been studied and generally accepted as acceptable and, in fact, preferable to the cumulative effects of other sites all around the Bay Area, way back when that site was designated.

MR. GRAY: Well, I would further clarify by saying this: there is going to be, what, an additional 7.9 million cubic yards from this project, and I will offer to find this case and call your agency with it to see if it affects your situation. I will do that as a member of the Oceanic Society and as a citizen in the community.

It seemed like it was hitting some -- breaking this somewhat new law.

COLONEL LEE: We would be happy to receive that and give it appropriate weight. Thank you very much.

MR. GRAY: Your welcome.

MR. CHISHOLM: The second question from Gary Gray is: How much additional salt water intrusion will occur? How much will the fixed submerged barrier mitigate this?

Well, Gary and I talked during the break, and this

question is really attributable to Phase III of the [illegible] Baldwin Project. Our model studies show, and [illegible] in discussion with the State Regional Water Quality [illegible] indicate, and they have agreed with us, that the Phase III Project does not affect salt water intrusion in the [illegible].

That's all I've got.

COLONEL LEE: All right, the last question was for Mr. Milliken from BCDC. If you would please take the mic, Mr. Milliken.

MR. MILLIKEN: The question I have written [illegible] is: Is BCDC's concern about dredge disposal at [illegible] related to environmental issues or navigation issues?

Basically, navigation issues. When we were looking at some of the various issues we did have a question or two about environmental. But, I think those are answered by the EIS, so I don't think we really have an environmental issue there.

The navigational issues involved here have to do with, probably, the problem that was defined at Alcatraz. And that's coupled with something that's in the Bay Plan, which came out, I know, in the comments when they were commenting about the Phase III in the channel [illegible] Point Edith.

This had to do with the -- the Bay Plan talks about disposal being made at upland locations and [illegible]

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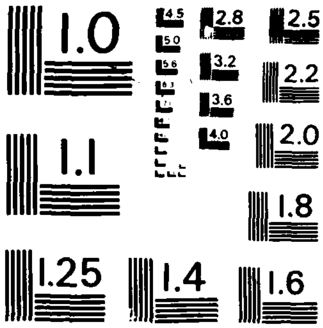
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in the bay only when these are not feasible. This is probably the area that the Commission will want to look at. Not to say that they are making a conclusion that you wouldn't want to use the Alcatraz site.

But, I think they need to look at that in light of comments they made earlier.

COLONEL LEE: I'd like to elaborate on that, because that was my question. You started out saying that it's a navigational issue but they you ended up sounding like it's an environmental issue. And so I'm still a little bit confused.

MR. MILLIKEN: All right, then we have two issues, basically.

COLONEL LEE: In other words, are you concerned with the height of the pinnacle at Alcatraz --

MR. MILLIKEN: Yes.

COLONEL LEE: -- or are you concerned with the benthos damage at Alcatraz?

MR. MILLIKEN: We are not as concerned -- we are not concerned about the benthos, merely because we think Fish and Game and Fish and Wildlife will worry about those. Not that we're completely blind to that particular environmental impact, but I mean I don't think we will belabor it.

We are concerned, at least at this time about the mound at Alcatraz and the capacity that remains there. We

would then also, I think, address the use of Alcatraz as opposed to an upland site merely because the Bay Plan addresses it in that particular fashion.

And I would think there is enough flexibility in there to be able to address that and find the Alcatraz site favorable. But, I think it will probably be addressed by the Commission.

COLONEL LEE: Okay, thank you.

MR. MILLIKEN: Does that answer that portion of the question?

COLONEL LEE: Yes.

MR. MILLIKEN: You have a further one: Does BCDC want the Corps to file for consistency determination, or have we done so, by the EIS?

It is my understanding that we do want you to file for a consistency determination. If I were to find out differently in the near future I will get in touch with you. But, as of now that's my understanding.

COLONEL LEE: Okay, thank you very much.

Well, it's all gone very smoothly and swiftly. Are there any further questions that you didn't have a chance to write down which you would like to verbally ask at this time?

MR. MILLIKEN: I have one.

COLONEL LEE: The only obligation is that you

return to the front of the room so we can get you on the tape recording.

MR. MILLIKEN: One of the things that I was looking for when I went through the EIS -- and I was prompted to look for it because when we were looking at some of the environmental things that the Port of Oakland was -- I'm not aware whether going down the additional footage that you're proposing gets into a completely new dredging area. But, if it does, is investigation being made as to any intrusion into a fresh water aquifer at that depth?

And I didn't see this addressed in the EIS. This is probably also going to be a question we will ask when we comment.

(Discussion among the staff.)

MR. CHISHOLM: Ken?

MR. KUHN: I'll try.

COLONEL LEE: Well, if you don't know just say so.

MR. KUHN: As far as I know, there are no potable or fresh water wells being used in the near vicinity, whereas along Oakland Inner Harbor there are approximately twenty-five wells that have been identified. And that's the reason why that issue came up there.

This issue has not arisen because, I guess, the absence of any wells that are being used for irrigation or potable purposes.

COLONEL LEE: Any further questions?

(No response.)

Well, at this time I would like to remind you all that there is still time to furnish us any comments you may have on the Draft Design Memorandum or EIS up until 20 March 1984. The Final Design Memorandum and EIS will be out for public review in mid-April and you will have a chance to comment on that.

It is our plan and schedule at the moment that before the end of this fiscal year we will have completed design and actually be under construction. And we are funded for approximately sixteen-million dollars worth of construction in FY 85, if you had a chance to look at the President's Budget.

If you would like to be place on a mailing list or provide additional comments please do so using the form that we handed out to you in the packet at the start of the hearing.

I want to thank you all for coming. I want to thank Supervisor Powers for coming and speaking to us. And I want to thank the Staff for doing a very good job of outlining a rather complicated project.

Good evening.

(Whereupon, at 9:45 p.m., the hearing was adjourned.)

C E R T I F I C A T I O N

This is to certify that the foregoing proceedings before the U.S. Army Corps of Engineers in the matter of:

John F. Baldwin Ship Channel, Phase II

February 16, 1984

Sausalito, California

were held as therein appears, and that this is the original transcript thereof.

Michael Connolly

MICHAEL CONNOLLY
Official Reporter

Dated: February 21, 1984

DRAFT
AGREEMENT BETWEEN
THE UNITED STATES OF AMERICA
AND
CONTRA COSTA COUNTY
FOR LOCAL COOPERATION
FOR CONSTRUCTION AND MAINTENANCE OF
AID TO NAVIGATION AT
RICHMOND HARBOR

THIS AGREEMENT, entered into this ____ day of __________, 19____, by and between the UNITED STATES OF AMERICA (hereinafter called the "GOVERNMENT"), represented by the Contracting Officer executing this Agreement, and CONTRA COSTA COUNTY (hereinafter called the "COUNTY").

WITNESS THAT:

WHEREAS, construction of the RICHMOND HARBOR PORTION OF THE SAN FRANCISCO BAY TO STOCKTON PROJECT (hereinafter called the "Project") was authorized by the River and Harbor Act of 1965 as contained in PL 89-298, dated 27 October 1965; and

WHEREAS, the County hereby represents that it has the authority and capability to furnish the non-Federal cooperation required by the Federal legislation authorizing the Project and by other applicable law.

NOW, THEREFORE, the parties agree as follows:

1. The County agrees that, if the Government shall commence construction of the Project substantially in accordance with Federal legislation authorizing such Project, the County shall, in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation applicable thereto, to wit:

(a) Provide without cost to the United States all lands, easements, and rights-of-way required for construction and maintenance of the Project and of aids to navigation.

(b) Agree to hold and save the United States free from damages which may result from construction and subsequent maintenance of the Project and of aids to navigation, except damages due to the fault or negligence of the United States or its contractors.

(c) Accomplish without cost to the United States such alterations as required in sewer, water supply, drainage, transportation, and other utility facilities and absorb any increased maintenance and operation costs that might result from such modifications and relocations.

(d) Prohibit erection of any structure within 125 feet of Project channels and basins.

(e) Provide and maintain without cost to the United States all necessary berthing areas, at a depth commensurate with Project depth, at all terminals and wharves to be served by the Project channels.

(f) Assume responsibility and pay damages, if necessary, pursuant to 42 U.S.C. 1962d-5b, in the event of the County's failure to perform the terms of this Agreement.

(g) Provide and maintain at local expense adequate public terminal and transfer facilities open to all on equal terms in accordance with plans approved by the Chief of Engineers.

2. The County hereby gives the Government the right to enter at reasonable times and in a reasonable manner, upon lands which the County owns or controls for access to the Project for the purpose of inspection, and for the purpose of operating, repairing, and maintaining the Project, if such inspection shows that the County for any reason is failing to complete, operate, repair and maintain the Project in accordance with the assurances hereunder and has persisted in such failure after a reasonable notice in writing by the Government delivered to the County. No completion, operation, repair and maintenance by the Government in such an event shall operate to relieve the County of responsibility to meet its obligations as set forth in paragraph 1 of this Agreement, or to preclude the Government from pursuing any other remedy at law or equity.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

THE UNITED STATES OF AMERICA

BY: ______________________

EDWARD M. LEE, JR.
Colonel, Corps of Engineers
District Engineer
Contracting Officer

For the Secretary of the Army

Date: ______________________

BOARD OF SUPERVISORS
CONTRA COSTA COUNTY

BY: ______________________

____

Date: ______________________

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